AS-7417

TYPE AH-5403

RADIO TELEPHONE TESTER

SERVICE MANUAL

ANDO ELECTRIC CO., LTD.

AS-7417

TYPE AH-5403

RADIO TELEPHONE TESTER

SERVICE MANUAL

CONTENTS

2

3

4

Attached Figures and Tables

5

SECTION 1

GENERAL INFORMATION

1.1 INTRODUCTION

This service manual contains information required for acceptance inspection, periodical inspection, performance test and calibration of TYPE AH-5403 RADIO TELEPHONE TESTER.

1.2 GENERAL

The performance test, calibration and maintenance of this apparatus requires many measuring instruments of various types just as it is so when radio equipment is to be adjusted and tested. This service manual describes calibrations for only the performances involved in normal use of this apparatus.

It is recommended that this apparatus be calibrated at least once a year, preferably every six months, in order to keep the apparatus in good operable condition. For repair, contact your local dealer.

1.3 SPECIFICATIONS

The specifications and performance characteristics of this apparatus are shown in Table 1-1.

6

Table 1-1 Specifications

Item	Specification/characteristic
(1) Overall characteristic	
RF input-output impedance	50 Ω unbalanced, VSWR 1.1 or less
Frequency range	25 to 520 MHz synthesizer method 100 Hz steps (by use of digital switches)
Stability of frequency standard	Within $\pm 0.1 \times 10^{-6}$
(2) RF signal generator	
Output	-10 to +80 dBμ (0 dBμ = 1 μV open-circuit voltage) 10 dB steps and +1 to -10 dB continuously variable
Output level accuracy	Within ±2 dB (at 0 dBμ output level)
Spurious	Harmonic -30 dB or less Non harmonic -40 dB or less
FM ranges	0 to ±1/±5/±10/±20 kHz/full scale
Deviation meter indication accuracy	Within ±10% of full scale
Internal modulation frequency	1 kHz and 50 to 2999 Hz (system modulation is possible)
External modulation input level	1 V rms or less (±20 kHz dev.)
Modulation distortion	1% or less (±3.5 kHz dev., demodulation band 400 Hz to 3 kHz)
Signal-to-noise ratio	42 dB or more (±3.5 kHz dev., demodulation band 400 Hz to 3 kHz)
(3) RF wattmeter	
Maximum measuring limit	25 W (continuous) 30 W (one-minute measurement at five-minute intervals)
Minimum measuring limit	100 mW
Scale ranges	0 to 1.5/7.5/15/30 W/full scale Linear watt indication
Scale indication accuracy	Within ±10% of full scale

7

Table 1-1 Specifications (Cont'd)

Item	Specification/characteristic
(4) FM linear detector	
Deviation ranges	0 to ±1/±5/±10/±20 kHz/full scale ±1 kHz/full scale ranges are for measuring CTCSS tone signal deviation. Demodulation band is 30 Hz to 500 Hz.
Deviation meter indication accuracy	Within ±10% of full scale
Deviation meter indication method	Peak detection (peak to peak/2)
Demodulation frequency ranges	30 Hz to 3 kHz and 400 Hz to 3 kHz
Distortion	1% or less (±3.5 kHz dev., demodulation band 400 Hz to 3 kHz)
Signal-to-noise ratio	42 dB or more (±3.5 kHz dev., demodulation band 400 Hz to 3 kHz)
(5) Frequency counter	
Frequency range	10 Hz to 520 MHz
Frequency accuracy	Within $\pm(0.1 \times 10^{-6} + 1$ count)
Input impedance	1 MΩ unbalanced 10 Hz to 50 MHz range 50 Ω unbalanced 50 to 520 MHz range
Input level sensitivity	20 mV rms or less
(6) AF signal output	
Frequency	1 kHz, 50 to 2999 Hz, external
Output impedance	Matching 600 Ω load, unbalanced Usable for 40 Ω load
Output	From within +5±1 dBm to −50 dBm or less (into 600 Ω resistive load)
Distortion	0.3% or less (1 kHz or external) 1% or less (50 to 2999 Hz)

8

Table 1-1 Specifications (Cont'd)

Item	Specification/characteristic
(7) AF level meter and distortion meter	
(AF level meter)	
Level measuring frequency range	30 Hz to 10 kHz
Input impedances	600 Ω and 100 kΩ
Scale ranges	+20 to −50 dBm (600 Ω)/full scale 8 ranges
Scale accuracy	Within ±1 dB
(Distortion meter)	
Distortion measuring frequency	1 kHz ±10 Hz
Fundamental wave elimination rate	50 dB or more
Scale ranges	0 to −40 dB/full scale 100 to 1%/full scale } Five ranges (With +10 and +20 dB ATTs for input level of 1 V or more)
Scale accuracy	Within ±10% or full scale
(8) AF oscillator	
Frequency range	50.0 to 299.9 Hz, synthesized in 0.1 Hz steps 50 to 2999 Hz, synthesized in 1 Hz steps
Output impedance	Matching 600 Ω load, unbalanced
Output	From within +5±1 dBm to −30 dBm or less (into 600 Ω resistive load)
Distortion	1% or less
(9) Monitor output	
Output	Approx. 0.8 V rms on the full scale of AF level meter (into 10 kΩ resistive load)
Voice monitor	Output terminal for external speaker provided on the rear panel.

9

Table 1-1 Specifications (Cont'd)

Item	Specification/characteristic
(10) Others	
Operating termperature range	+5 to +35°C
Power requirements	90 to 132 V, or 198 to 264 V AC, 48 to 63 Hz
	Approx. 80 VA
Dimensions	Approx. 222 (H) x 425 (W) x 350 (D) mm, without cover
	Approx. 222 (H) x 425 (W) x 390 (D) mm, with cover
Weight	Approx. 20 kg

10

SECTION 2

OUTLINE OF OPERATION

2.1 INTRODUCTION

This section outlines the operation of this apparatus.

2.2 OUTLINE OF OPERATION

A functional diagram of this apparatus is shown in Fig. 2-1. The apparatus consists of the following:

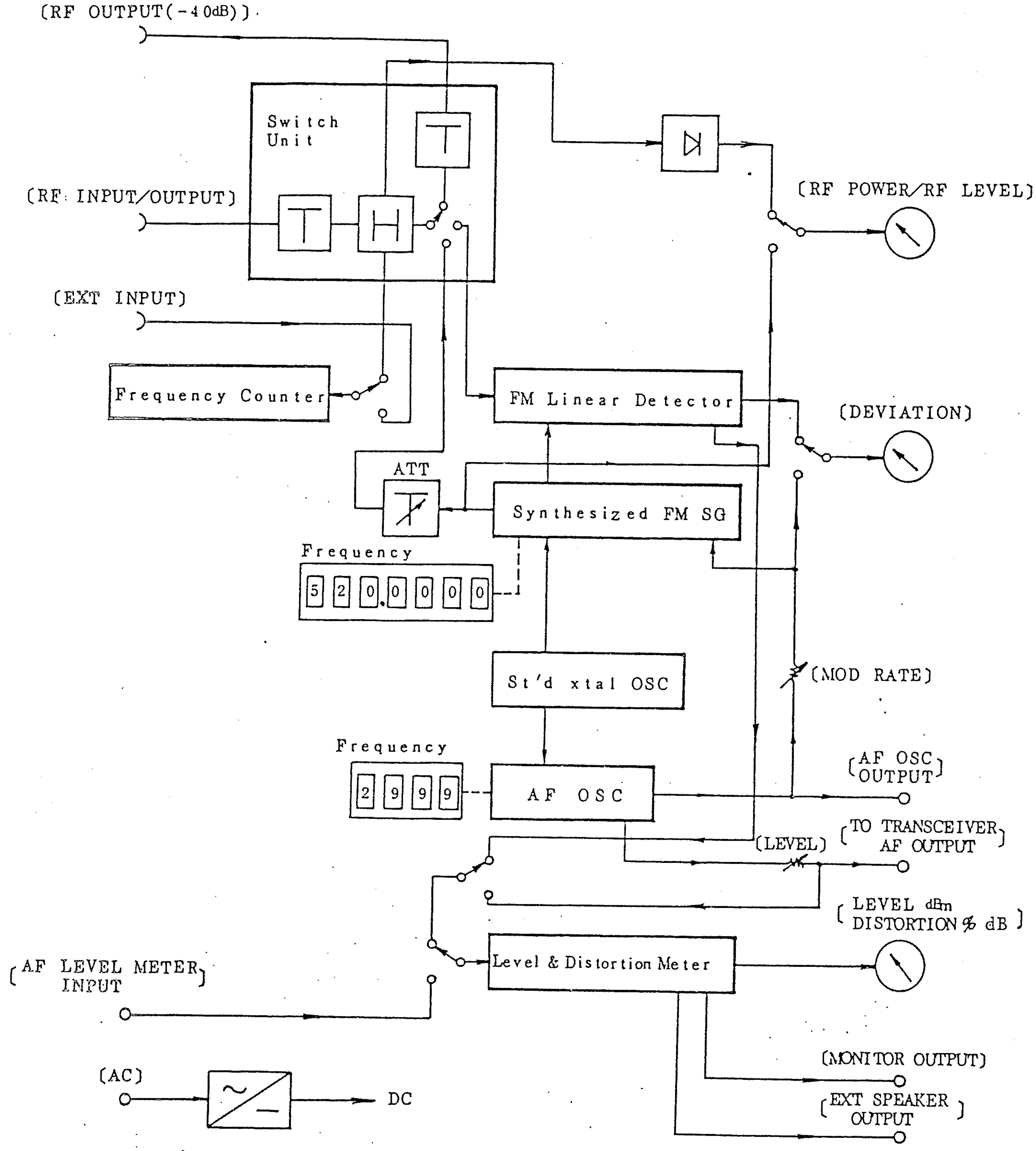
1. Switch unit
2. RF wattmeter
3. Reference signal generator
4. Synthesized FM signal generator
5. FM linear detector
6. AF oscillator
7. Level meter, distortion meter, and monitor
8. Frequency counter
9. Power supplies

2.2.1 Switch Unit

This unit is used for switching among test items. Not only RF signal connections, but also AF signal connections can be switched in this unit. When a test item is determined through switching in this unit, the apparatus is automatically set up for the test.

For the switching of RF signal connections, three relays designed for high frequency circuit are used, so that a good frequency response, isolation characteristic and VSWR characteristic are obtained.

Fig. 2-1 Functional diagram



12

Also, a 25-W, 15-dB fixed-resistance attenuator is incorporated to protect the circuit from damage attributable to high power.

2.2.2 RF Wattmeter

The RF wattmeter measures the transmission power of the radio equipment under test in the range of 100 mW to 30 W. In order to realize a linear watt scale, the input level of the detector is kept low and N-channel junction type field-effect transistors are incorporated in the detector. Since the detection output level is low, an amplifier is required for meter operation. To avoid the problem of temperature drifting to be taken into consideration when a DC amplifier is used, this RF power wattmeter uses a chopper incorporating FETs and an AC amplifier. A block diagram of the RF wattmeter is shown in Fig. 2-2.

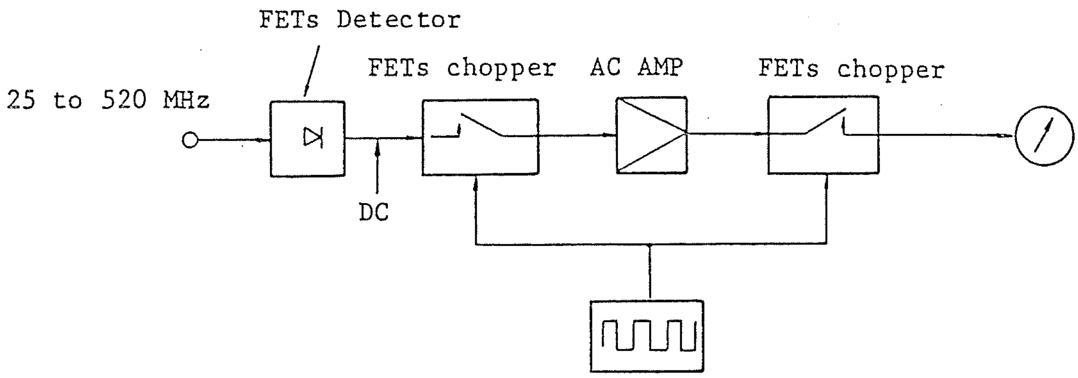


Fig. 2-2 Block diagram of RF wattmeter

/3

2.2.3 Reference Signal Generator

The reference signal generator is an oscillator unit to generate the reference signal for the synthesized FM signal generator, the AF oscillator and frequency counter. It is a high-accuracy crystal oscillator kept in a thermostatic oven. The 1 kHz AF test signal is also generated by frequency-dividing the reference signal generated by this oscillator.

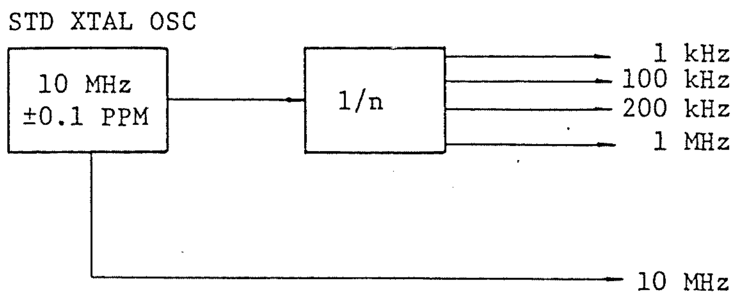


Fig. 2-3 Block diagram of reference signal generator

2.2.4 Synthesized FM Signal Generator

The synthesized FM signal generator that is at the heart of this apparatus is a standard FM signal generator which employs the synthesizer method making use of a PLL (Phase Locked Loop). This apparatus incorporates five VCOs (Voltage Controlled Oscillators). The PLL locks their outputs in relation to the reference signal discussed in 2.2.3 for frequency stabilization.

Their oscillations are variable in 100-Hz steps to range from 25 to 520 MHz. The output frequencies of VCOs are synthesized and the signal obtained by synthesis is sent to the level control circuit incorporating PIN diodes for stabilization. Next, the theory of frequency control will be briefly discussed.

14

This apparatus uses digital signals for frequency variation in two ways. In one way, the reference frequency is divided by use of a programmable frequency divider and the divided frequency is controlled by means of digital signals for frequency variation. In the other way, the VCO frequency is varied by using the analog signal (d.c. voltage) obtained by processing digital signals through a D/A converter.

This apparatus uses the former method for frequency setting on the positions of hundreds Hz to tens MHz, and the latter method on the position of hundreds MHz.

The theory of each method is described in the following:

(1) Frequency variation utilizing programmable frequency divider

The theory of frequency variation utilizing a programmable frequency-divider is illustrated in Fig. 2-4. The VCO, programmable frequency divider, phase detector and the low pass filter shown in Fig. 2-4 form a phase synchronizing loop.

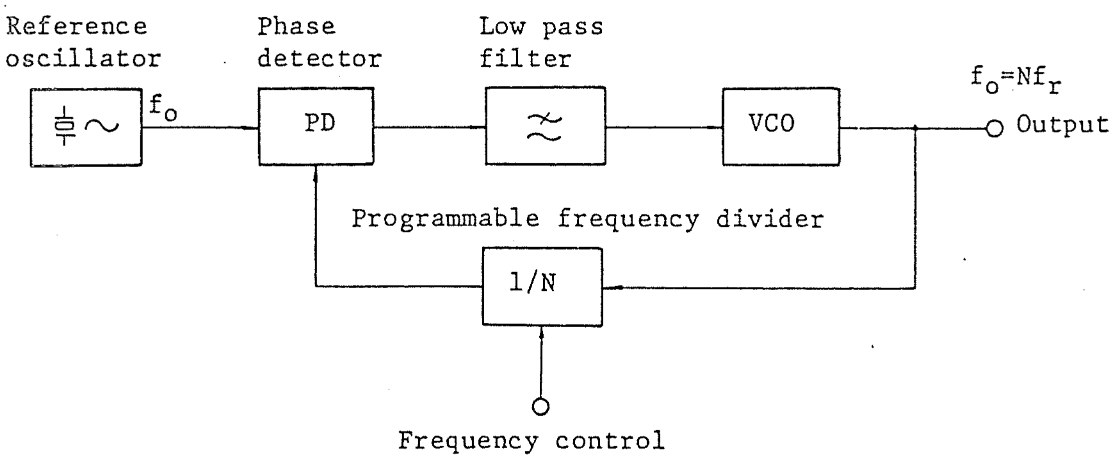


Fig. 2-4 Frequency variation utilizing programmable frequency divider

15

When the phase is locked to the reference frequency fr, the oscillation frequency fo of VCO is expressed as follows:

$$fo = N \cdot fr$$

where N = factor applied for frequency division by programmable frequency divider

As expressed above, the frequency of the output signal equals N times the reference frequency fr and, therefore, changing the value of N varies the output signal frequency.

(2) Frequency variation utillizing D/A converter

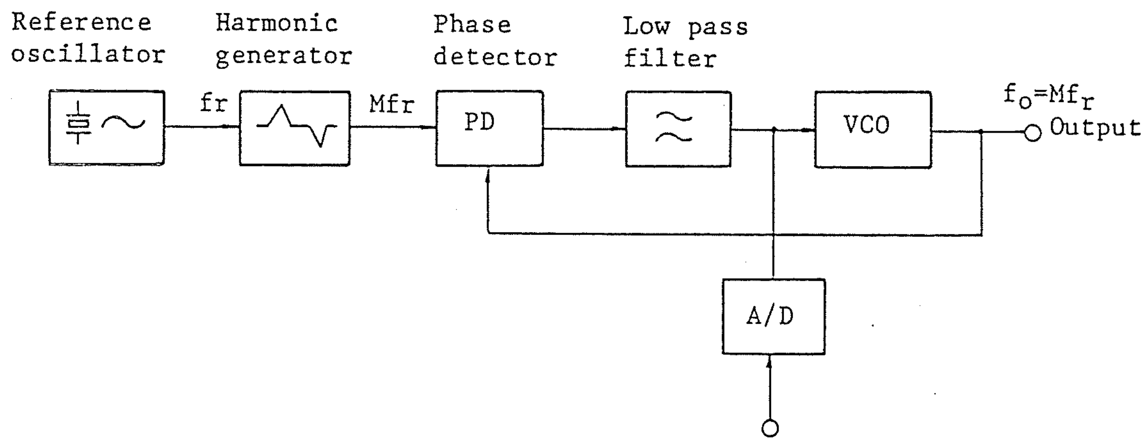


Fig. 2-5 Frequency variation utilizing D/A converter

The VCO, PD and LPF shown in Fig. 2-5 form a phase synchronizing loop. The harmonic generator generates a harmonic signal of frequency equal to (2, 3, 4, ... M) times the reference frequency and the harmonic signal generated is sent to the PD.

When the oscillation frequency fo of VCO nears an integer times the reference frequency, the phase is locked by the phase

16

synchronizing loop. It is therefore possible to obtain a desired frequency equal to an integer times the reference frequency fr by applying a proper d.c. voltage to the VCO to make its oscillation frequency fo near the desired frequency equal to an integer times the reference frequency.

Processing the d.c. voltage through the D/A converter makes frequency control by use of digital signals possible.

The circuit structure of the synthesized FM signal generator of this apparatus is shown in Fig. 2-6.

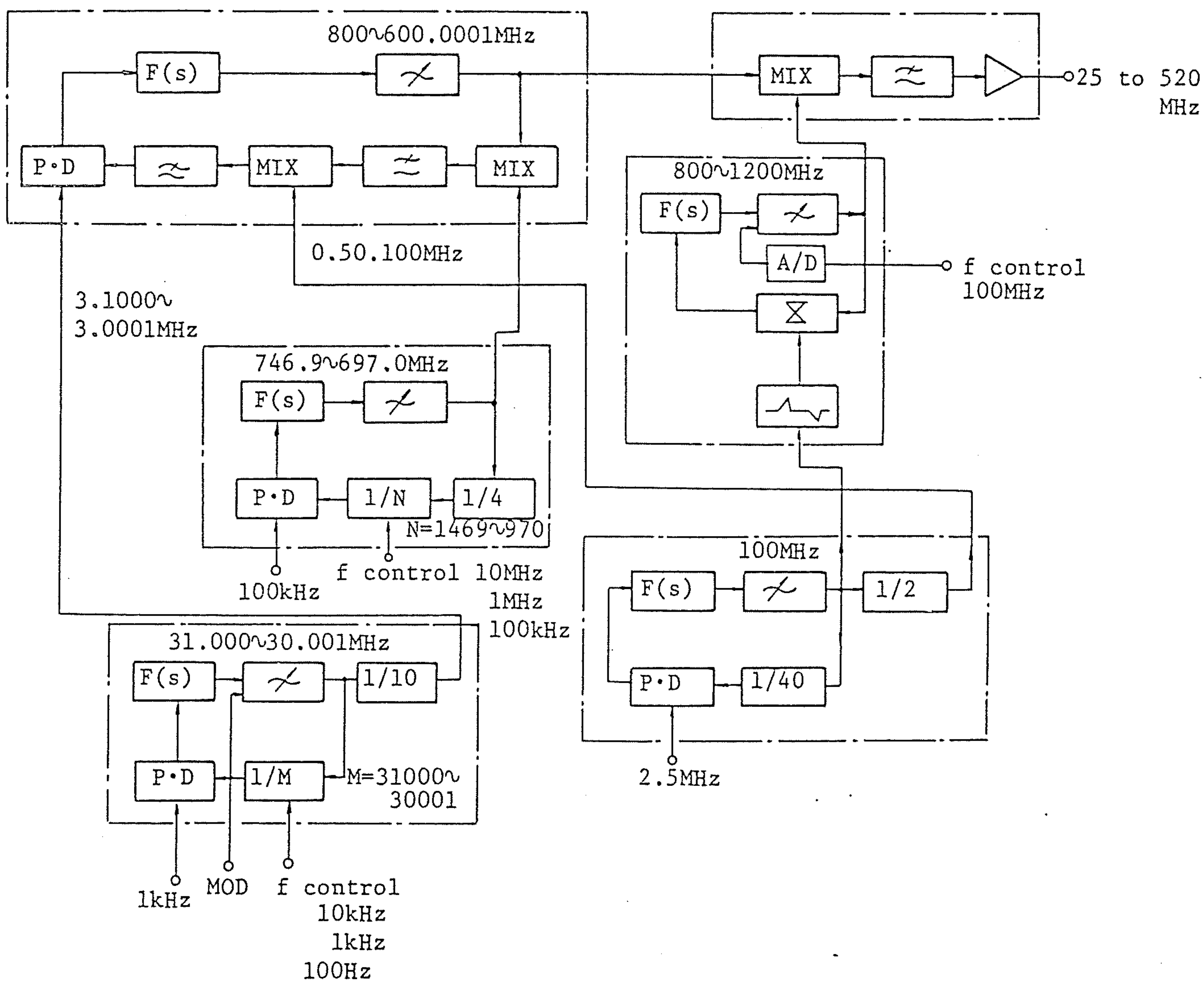


Fig. 2-6 Circuit structure of synthesized FM signal generator

/7

2.2.5 FM Linear Detector

The FM linear detector measures the modulation characteristic of a transmitter. Its circuit structure is shown in Fig. 2-7.

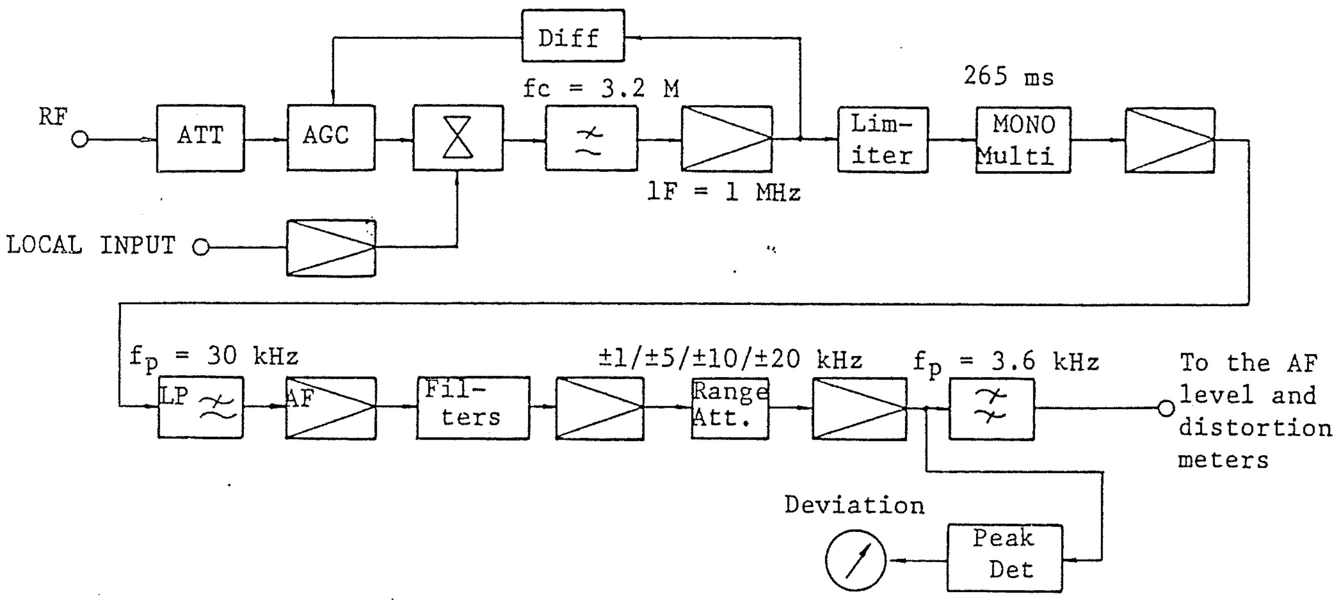


Fig. 2-7 Circuit structure of FM linear detector

The local oscillator uses the RF signal generator described in 2.2.4 by shifting the setting by the IF frequency (1 MHz). The setting is automatically done just by placing the test item selection switch at [TRANSMITTER TEST].

An input difference of up to about 25 dB (100 mW to 30 W) is possible depending on the radio equipment under test. The amplitude of the IF signal is therefore kept constant by means of the AGC in order to stabilize the characteristic.

A pulse count system making use of a monostable multivibrator is employed for the FM detector circuit in order to realize adjustment-free operation.

The deviation meter circuit incorporates a peak detector circuit and displays the value of P-P/2. so that deviation of the distorted waveforms generated by the IDC circuit can also be accurately measured.

2.2.6 AF Oscillator

The AF oscillator incorporating a synthesizer system which contains a PLL generates AF signals ranging in frequency from 50 to 2999 Hz. Its circuit structure is shown in Fig. 2-8.

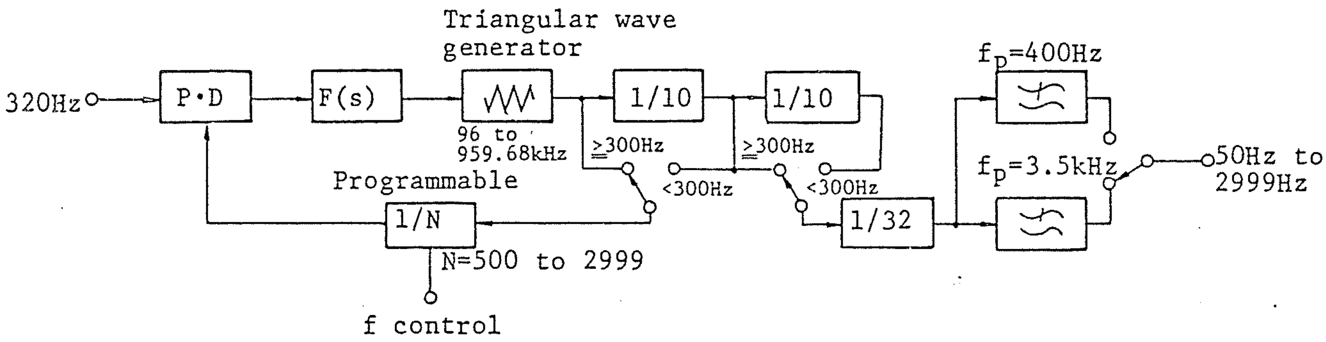


Fig. 2-8 Circuit structure of AF oscillator

2.2.7 Level Meter, Distortion Meter, and Monitor

The level meter, the distortion meter and the monitor are used to measure the modulation and demodulation characteristics of transmitters and receivers. Voice monitoring is also possible. The circuit structure of the meters and monitor is shown in Fig. 2-9.

19

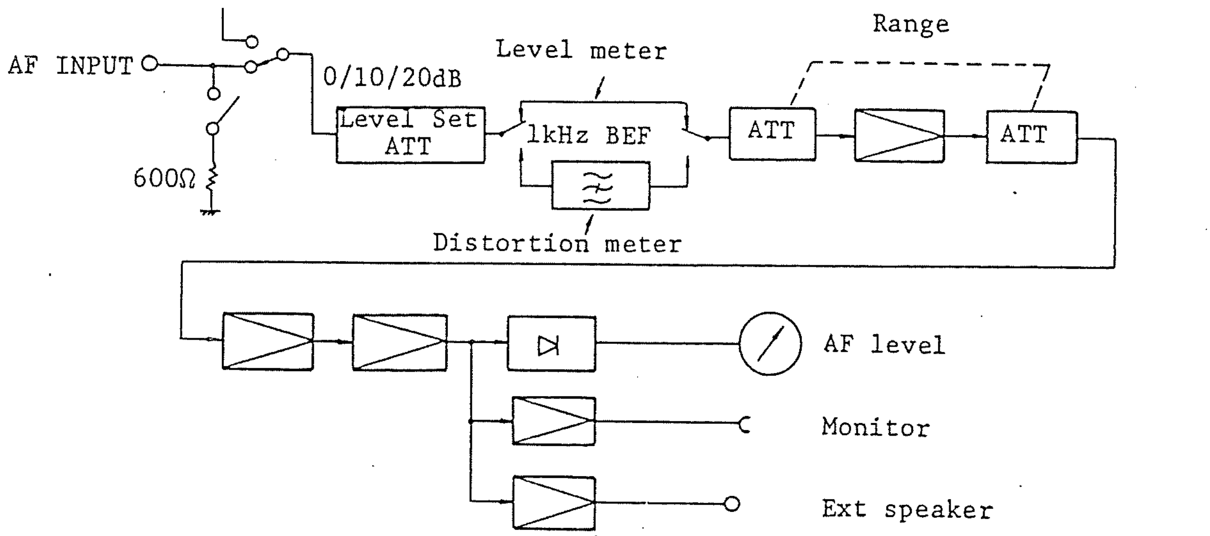


Fig. 2-9 Circuit structure of level meter, distortion meter, and monitor

Connection switching is automatically made for the measuring of the absolute AF level value or distortion, or for the relative-level setting for measuring the S/N ratio depending on the setting of the test item selection switch of this apparatus.

2.2.8 Frequency Counter

The frequency counter is used for testing or adjusting the transmission frequency or CTCSS tone frequency of a transmitter and the local oscillation frequency of a receiver.

2.2.9 Power Supplies

This apparatus obtains three power supplies, +5 V, +12 V and -12 V DC, from specified commercial AC power supply by using a three-terminal regulator.

20

SECTION 3

PERFORMANCE TEST

3.1 INTRODUCTION

This section describes how to conduct the performance test on this apparatus to verify that the apparatus is in normal condition satisfying the specifications.

Periodical inspection and proper maintenance not only support the reliability of data obtained from this apparatus but contribute toward keeping the apparatus operable for long. It is desirable to inspect this apparatus at least once a year, preferably every six months, conforming to the instructions given in this section.

If, as a result of the performance test conducted as described in this section, the apparatus is found short of the performance specifications, readjust it conforming to the instructions given in SECTION 4 "CALIBRATION." If the specific readjustment to be made is not covered by SECTION 4 (the test names marked with * in this section concern performances which are not covered by SECTION 4), contact your local dealer.

3.2 INSTRUMENTS REQUIRED FOR PERFORMANCE TEST AND CALIBRATION

The performance test is to be conducted for the purpose of verifying that the apparatus is in normal condition satisfying the specifications. To conduct the performance test, the necessary testing instruments must be prepared and they must be correctly connected to the apparatus. The required testing instruments and performances are listed in Table 3-1.

21

Besides at maintenance time, the performance test is to be conducted also when the apparatus is delivered and after it is reparied.

In the performance test, the frequency stability test as described in 3.3.1.1 is to be conducted first. The other tests may be conducted in any order. Note that a widely fluctuating power supply, major noise interference, external noise and vibration must be avoided for the performance test.

Table 3-1

Instrument	Performance requirement		Remark
Frequency counter	Frequency range	10 Hz to 520 MHz	
	Resolution	0.1 Hz	
	Stability	0.05×10^{-6} or more	
	Input sensitivity	10 mV or less	
Field strength meter	Frequency range	25 to 520 MHz	
	Input impedance	50 Ω	
	Measuring range	+80 to −10 dBμ (0 dBμ = 1 μV)	
Spectrum analyzer	Frequency range	10 kHz to 1700 MHz	
	Input impedance	50 Ω	
	Measuring range	−110 to +20 dBm	
	Resolution	100 Hz	
FM linear detector	Frequency range	25 to 520 MHz	
	Frequency deviation	0 to ±20 kHz	
	Demodulation band	30 Hz to 3 kHz 400 Hz to 3 kHz	
	Demodulation distortion	0.3% or less	
	S/N	50 dB or more	
Distortion meter	Frequency range	30 Hz to 20 kHz	
	Level measuring range	1 mV to 10 V/ full scale	
	Distortion measuring range	0.1% to 100%	

22

Table 3-1 (Cont'd)

Instrument	Performance requirement		Remark
Low frequency oscillator	Frequency range	30 Hz to 10 kHz	
	Output impedance	600 Ω	
	Output voltage	1 mV to 3 V	
	Distortion rate	0.1% or less	
RF amplifier	Frequency range	25 to 520 MHz	
	Input level	80 dBμ	
	Voltage gain	About 20 dB	
	Maximum output level	110 dBμ	
Low frequency level meter	Frequency range	30 Hz to 20 kHz	
	Measuring range	1 mV to 10 V	
	Input impedance	100 kΩ or more	
	Measuring error	5% or less	
	Level frequency response	0.1 dB or less	
RF power SG or radio equipment	Frequency range	25 to 520 MHz	
	Output impedance	50 Ω	
	Output power	100 mW to 30 W	
RF wattmeter	Frequency range	25 to 520 MHz	
	Input impedance	50 Ω	
	Measuring range	0.1 to 30 W	
	Accuracy	±1% or less	
FM signal generator	Frequency range	25 to 520 MHz	
	Output impedance	50 Ω	
	Output level	133 dBμ(+20 dBm) or more	
	Modulation	FM max 20 kHz	
	S/N	50 dB or more (for 3.5 kHx deviation)	
High frequency level meter	Frequency range	1 to 520 MHz	
	Measuring range	-40 to +20 dBm	
	Impedance	50 Ω	

Table 3-1 (Cont'd)

Instrument	Performance requirement		Remark
VSWR bridge	Frequency range	25 to 520 MHz	
	Impedance	50 Ω	
	Return loss measuring range	40 dB or more	
Oscilloscope	Frequency range	DC to 50 MHz	
	Sensitivity	10 mV/DIV	
Standard resistance attenuator	Frequency range	25 to 520 MHz	
	Attenuation	90 dB or more (in 0.1 dB steps)	
	Impedance	50 Ω	

24

3.3 PERFORMANCE TEST

3.3.1 Overall Performance

3.3.1.1 Frequency accuracy test

Specification: $\pm 0.1 \times 10^{-6}$

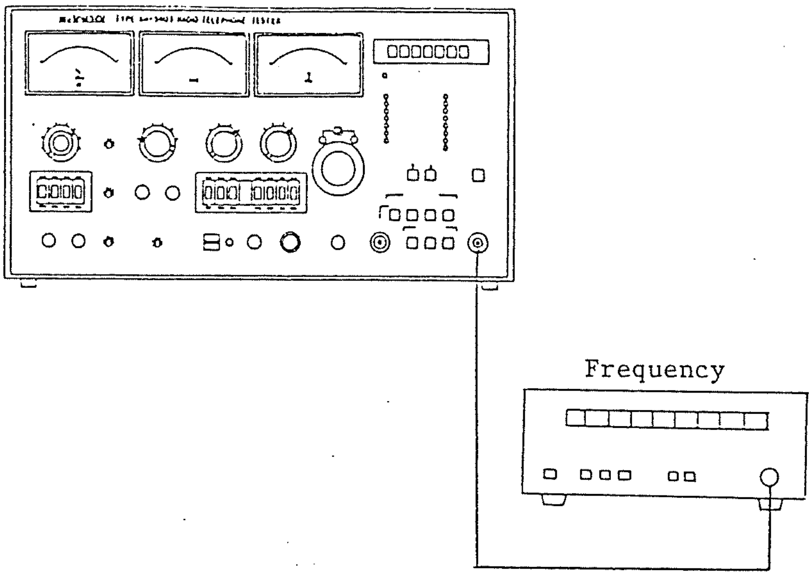


Fig. 3-1 Frequency accuracy test

(1) Connect a frequency counter to the [RF INPUT/OUTPUT 50 Ω MAX. 25 W] connector as shown in Fig. 3-1.

(2) Set the controls of this apparatus as follows:

Test item	[AF INPUT LEVEL] of [RECEIVER TEST]
[OUTPUT LEVEL dBμ] dial	[80]
[+1 ∿ -10 dBμ]	[+1 dBμ] (Output level meter indication)
[RF FREQUENCY 25 ∿ 520 MHz]	[25.0000]
[MOD SELECT]	[OFF]
Other controls	Any position

25

(3) Count the frequency with the frequency counter and calculate the stability by using the following equation:

$$\text{Stability} = \frac{f_R - f_S}{f_S}$$

where f_R = frequency counter reading

f_S = frequency setting

(4) When the frequency is set to 25 MHz, the counter reading must be within the following range:

24.9999975 MHz to 25.0000025 MHz

(Allowable error for 25 MHz is 2.5 Hz.)

> NOTE
>
> (1) Adequately warm up the frequency counter to bring it into a stable state beforehand.
>
> (2) Warm up this apparatus at least for 15 minutes to bring it into a stable state beforehand.

(5) Next, set the [RF FREQUENCY 25 ∿ 520 MHz] to [520.0000] and count the frequency. For the setting of 520 MHz, the frequency counter must give a reading within the following range:

519.999948 MHz to 520.000052 MHz

(Allowable error for 520 MHz is 52 Hz.)

> NOTE
>
> Since the output of this apparatus is +80 dBμ(5 mV when terminated in 50 Ω), prepare a high-sensitivity frequency counter.
>
> Also, when using a high frequency amplifier, take care not to allow amplifier noise to cause frequency counter malfunction.

3.3.1.2 RF input-output impedance test*

Specification: 50 Ω unbalanced, VSWR 1.1 or less

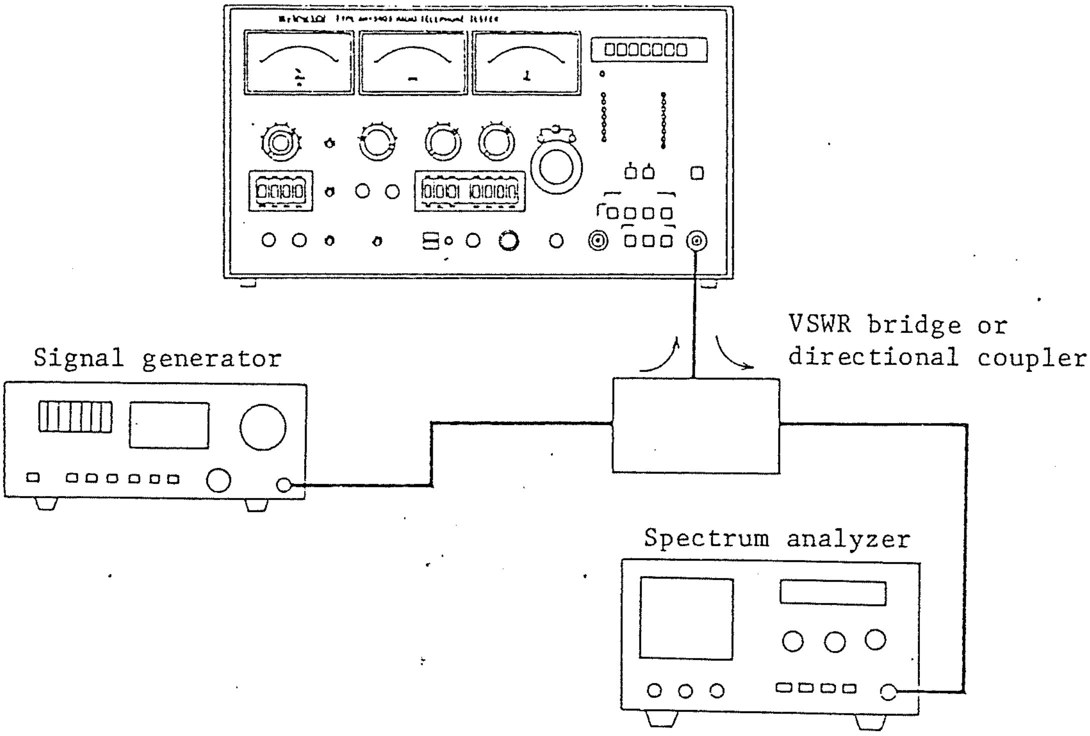


Fig. 3-2 RF input-output impedance test

(1) Connect the instruments as shown in Fig. 3-2.

(2) Arbitrarily set the controls of this apparatus.

(3) By using the VSWR bridge (or directional coupler), read the level shown by the spectrum analyzer while leaving the VSWR bridge disconnected from this apparatus. Next, connect the VSWR bridge to the [RF INPUT/OUTPUT 50 Ω MAX. 25 W] of this apparatus and read the level shown by the spectrum analyzer.

The level difference (dB) between the two readings represents the return loss.

27

(4) Conduct measurement for 25, 250 and 520 MHz.

> NOTE
>
> (1) When the [RECEIVER TEST] is set as test item, set the [RF FREQUENCY 25 ∿ 520 MHz] to be different from the frequency set for measurement so as not to affect measurement.
>
> (2) Set the signal source output level to about 0 dBm (113 dBμ).

(5) The relationship between the return loss and the VSWR can be expressed as follows:

$$Ae = 20 \log_{10} \frac{S + 1}{S - 1}$$

$$S = \frac{1 + 10^{-\frac{Ae}{20}}}{1 - 10^{-\frac{Ae}{20}}}$$

where S = VSWR

Ae = return loss (dB)

For example, when Ae is 30 dB, VSWR (S) is:

$$S = \frac{1 + 10^{-\frac{30}{20}}}{1 - 10^{-\frac{30}{20}}} = \frac{1 + 0.03}{1 - 0.03} = 1.06$$

Table 3-2 is a return loss/VSWR conversion table.

(6) Verify that the return loss is 26.4 dB or more.

VSWR	Return loss
1.1 or less	26.4 dB or more

28

NOTE

Use of a tracking generator, which is synchronized with the frequency spectrum analyzer, instead of the signal generator makes it possible to measure the characteristic for 25 to 520 MHz through a single sequence of testing procedures.

Table 3-2 Conversion of return loss into VSWR

Return loss (dB)	VSWR	Return loss (dB)	VSWR	Return loss (dB)	VSWR
0.0	∞	4.8	3.710	9.6	1.990
0.1	174.4	4.9	3.639	9.7	1.973
0.2	86.72	5.0	3.569	9.8	1.957
0.3	58.00	5.1	3.503	9.9	1.941
0.4	43.44	5.2	3.440	10.0	1.925
0.5	34.78	5.3	3.379	10.1	1.910
0.6	28.98	5.4	3.320	10.2	1.894
0.7	24.84	5.5	3.320	10.3	1.880
0.8	21.73	5.6	3.263	10.4	1.865
0.9	19.32	5.7	3.209	10.5	1.851
1.0	17.40	5.8	3.156	10.6	1.837
1.1	15.81	5.9	3.106	10.7	1.824
1.2	14.50	6.0	3.057	10.8	1.810
1.3	13.39	6.1	3.010	10.9	1.798
1.4	12.43	6.2	2.964	11.0	1.785
1.5	11.61	6.3	2.920	11.1	1.772
1.6	1.089	6.4	2.877	11.2	1.760
1.7	10.25	6.5	2.836	11.3	1.748
1.8	9.684	6.6	2.796	11.4	1.737
1.9	9.178	6.7	2.757	11.5	1.725
2.0	8.723	6.8	2.720	11.6	1.714
2.1	8.311	6.9	2.684	11.7	1.703
2.2	7.936	7.0	2.649	11.8	1.692
2.3	7.598	7.1	2.615	11.9	1.681
2.4	7.285	7.2	2.582	12.0	1.671
2.5	6.997	7.3	2.549	12.1	1.661
2.6	6.731	7.4	2.518	12.2	1.651
2.7	6.485	7.5	2.488	12.3	1.641
2.8	6.257	7.6	2.458	12.4	1.631
2.9	6.045	7.7	2.430	12.5	1.622
3.0	5.847	7.8	2.402	12.6	1.612
3.1	5.662	7.9	2.375	12.7	1.603
3.2	5.489	8.0	2.348	12.8	1.594
3.3	5.327	8.1	2.323	12.9	1.586
3.4	5.175	8.2	2.298	13.0	1.577
3.5	5.030	8.3	2.273	13.1	1.568
3.6	4.894	8.4	2.250	13.2	1.560
3.7	4.765	8.5	2.227	13.3	1.552
3.8	4.645	8.6	2.204	13.4	1.544
3.9	4.529	8.7	2.182	13.5	1.536
4.0	4.420	8.8	2.161	13.6	1.528
4.1	4.315	8.9	2.140	13.7	1.520
4.2	4.216	9.0	2.120	13.8	1.513
4.3	4.122	9.1	2.100	13.9	1.506
4.4	4.033	9.2	3.081	14.0	1.498
4.5	3.947	9.3	2.061	14.1	1.491
4.6	3.864	9.4	2.043	14.2	1.484
4.7	3.786	9.5	2.025	14.3	1.478

30

Table 3-2 Conversion of return loss into VSWR (Cont'd)

Return loss (dB)	VSWR	Return loss (dB)	VSWR	Return loss (dB)	VSWR
14.4	1.471	18.3	1.277	31.0	1.058
14.5	1.464	18.4	1.273	31.5	1.055
14.6	1.458	18.5	1.270	32.0	1.051
14.7	1.451	18.6	1.266	32.5	1.048
14.8	1.445	18.7	1.263	33.0	1.046
14.9	1.439	18.8	1.259	33.5	1.043
15.0	1.432	18.9	1.256	34.0	1.041
15.1	1.426	19.0	1.253	34.5	1.038
15.2	1.421	19.1	1.249	35.0	1.036
15.3	1.415	19.2	1.246	35.5	1.034
15.4	1.409	19.3	1.243	36.0	1.032
15.5	1.404	19.4	1.240	36.5	1.030
15.6	1.398	19.5	1.237	37.0	1.029
15.7	1.393	19.6	1.234	37.5	1.027
15.8	1.387	19.7	1.231	38.0	1.026
15.9	1.382	19.8	1.228	38.5	1.024
16.0	1.377	19.9	1.225	39.0	1.023
16.1	1.372	20.0	1.222	39.5	1.021
16.2	1.366	20.5	1.208	40.0	1.020
16.3	1.362	21.0	1.196	41.0	1.018
16.4	1.357	21.5	1.184	42.0	1.016
16.5	1.352	22.0	1.172	43.0	1.014
16.6	1.347	22.5	1.162	44.0	1.013
16.7	1.342	23.0	1.152	45.0	1.011
16.8	1.338	23.5	1.143	46.0	1.010
16.9	1.333	24.0	1.135	47.0	1.009
17.0	1.329	24.5	1.127	48.0	1.008
17.1	1.324	25.0	1.119	49.0	1.007
17.2	1.320	25.5	1.112	50.0	1.006
17.3	1.316	26.0	1.105	51.0	1.0056
17.4	1.312	26.5	1.099	52.0	1.0050
17.5	1.308	27.0	1.094	53.0	1.0044
17.6	1.304	27.5	1.088	54.0	1.0040
17.7	1.300	28.0	1.083	55.0	1.0036
17.8	1.296	28.5	1.078	56.0	1.0032
17.9	1.292	2.90	1.074	57.0	1.0028
18.0	1.288	29.5	1.069	58.0	1.0026
18.1	1.284	30.0	1.065	59.0	1.0022
18.2	1.280	30.5	1.061	60.0	1.0020

3.3.2 RF Signal Generator

3.3.2.1 Output level accuracy test

Specification: Within ± 2 dB at output level of 0 dBμ

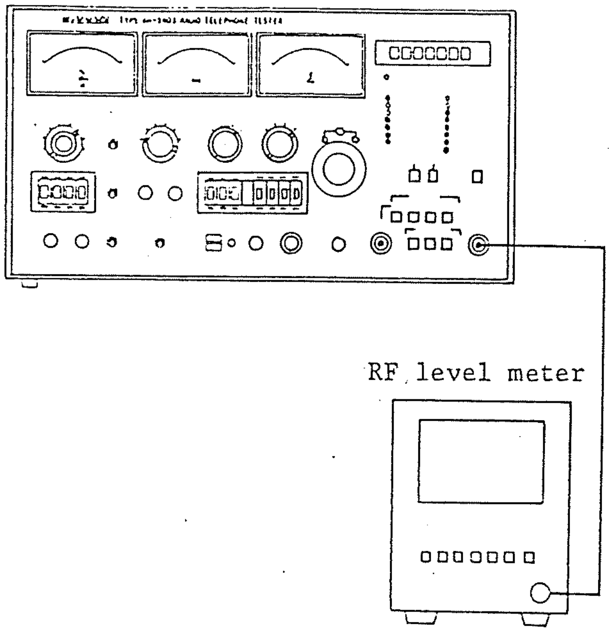


Fig. 3-3 Output level accuracy test

(1) Set the controls of this apparatus as follows:

Test item	[AF INPUT LEVEL] of [RECEIVER TEST]
[OUTPUT LEVEL dBu] dial	[80]
[MOD SELECT]	[OFF]
Other controls	Any position

(2) Bring the output level meter indication to [0 dBμ] by turning the output level fine adjustment control [+1 ∿ -10 dBμ] of this apparatus.

(3) Connect a RF level meter terminated in 50 Ω to the [RF INPUT/OUTPUT 50 Ω MAX. 25 W] connector of this apparatus as shown in Fig. 3-3 and measure the output level of the apparatus.

(4) Conduct measurement for 25, 250 and 520 MHz.

(5) For the level meter reading of V dBμ, output level error d can be calculated by using the equation shown below. Make sure that the calculated error is within ± 2 dB.

$$d\ (dB) = V - 80$$

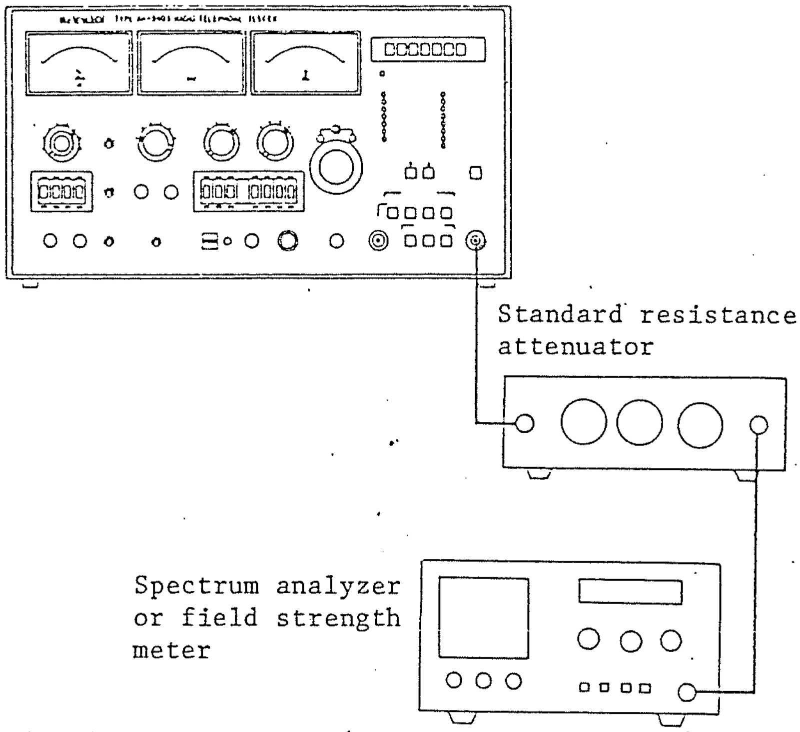


Fig. 3-4 Output level accuracy test (for low output levels)

(6) Next, set the [OUTPUT LEVEL dBμ] toggle switch to [60] and read the output level. Error d' can be calculated as shown below.

$$d'\ (dB) = V' - 60$$

(7) As shown in Fig. 3-4, connect a spectrum analyzer of field strength meter to the [RF INPUT/OUTPUT 50 Ω MAX. 25 W] connector of this apparatus via a standard resistance attenuator, and measure the output accuracy at lower levels by the substituting method using the standard resistance attenuator.

(8) Set the output level to [60 dBμ] by turning the [OUTPUT LEVEL dBμ] toggle switch to the right side. Set the attenuation of the standard resistance attenuator to 62 dB.

(9) When the output level is lowered by changing the setting of the [OUTPUT LEVEL dBμ], also change the setting of the standard resistance attenuator so as to keep the reading of the spectrum analyzer or field strength meter constant. Calculate error α for 0 dBμ by using the following equation and make sure that it is within ±2 dB.

α(dB) = (Change in the setting of the standard resistance attenuator) - (Change in the dial setting of this apparatus)

> NOTE
>
> (1) When the [OUTPUT LEVEL dBμ] of this apparatus is set to 60 dBμ, set the standard resistance attenuator to 62 dB and the level indication of the spectrum analyzer or field strength meter to a desired point.
>
> (2) Next, set the [OUTPUT LEVEL dBμ] dial to 50 dBμ and change the setting of the standard resistance attenuator to restore the reading of the spectrum analyzer or field strength meter obtained in step (1).
>
> (3) Lower the output level in stages until 0 dBμ repeating the test for each setting.

3.3.2.2 Spurious test*

Specification: Spurious signals against fundamental wave level

Harmonic	-30 dB or less
Non-harmonic	-40 dB or less

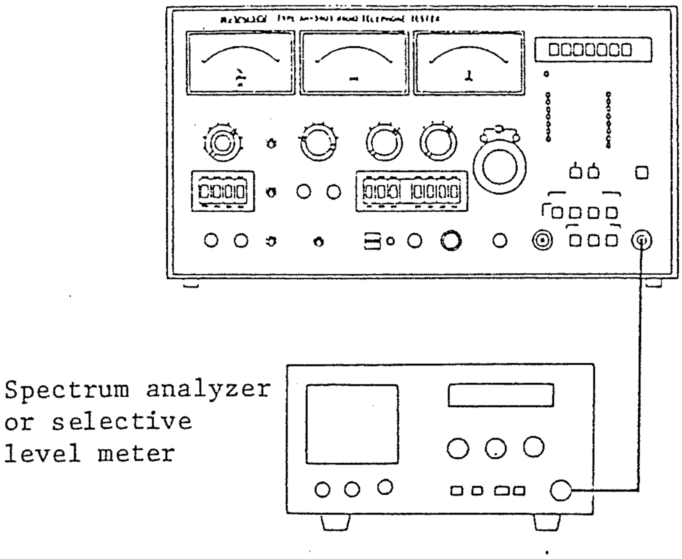


Fig. 3-5 Spurious test

(1) Set the controls of this apparatus as follows:

Test item	[AF INPUT LEVEL] of [RECEIVER TEST]
[OUTPUT LEVEL dBμ] dial	[80]
[+1 ∿ 10 dBμ] knob	0 dBμ (Output level meter indication)
[MOD SELECT] switch	[OFF]
Other control	Any position

(2) Connect a spectrum analyzer or selective level meter to the [RF INPUT/OUTPUT 50 Ω MAX. 25 W] connector of this apparatus as shown in Fig. 3-5 and measure the difference between the fundamental wave level and the spurious level. Make sure that the level difference satisfies the specification.

NOTE

(1) Carefully check if spurious signals are generated inside the spectrum analyzer or selective level meter.

(2) The non-harmonic spurious signals are specified to be -40 dB or less for a frequency band of 25 to 520 MHz. If -40 dB is exceeded, recheck if the frequency is within the specified band.

36

3.3.2.3 Frequency deviation meter indication accuracy test

Specification: Within ±10% of full scale

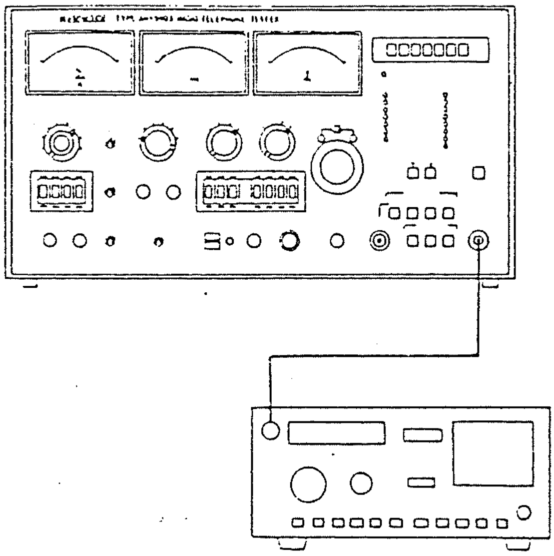


Fig. 3-6 Frequency deviation meter indication accuracy test

(1) Connect an FM linear detector to the [RF INPUT/OUTPUT 50 Ω MAX. 25 W] connector of this apparatus as shown in Fig. 3-6.

(2) Set the controls of this apparatus as follows:

Test item	[AF INPUT LEVEL] of [RECEIVER·TEST]
[OUTPUT LEVEL dBμ] dial	[80]
[+1 ∿ -10 dBμ] knob	[0 dBμ] (Output level meter indication)
[MOD SELECT] switch	[1 kHz]
[1 kHz OR EXT] knob	Turn fully counterclockwise
[DEVIATION kHz] switch	[1]
[RF FREQUENCY 25 ∿ 520 MHz]	Set as desired between 25 and 520 MHz.
Other controls	Any position

37

(3) Push the [1 kHz OR EXT] knob of the [MOD RATE] to the [ON] position and bring the meter indication to the desired value by turning the knob. Measure the frequency deviation in this state with the FM linear detector and calculate the error by using the following equation:

$$\text{Error} = \frac{\text{Test frequency} - \text{Meter indication}}{\text{Full scale value}} \times 100\ (\%)$$

(4) Next, set the [DEVIATION kHz] to [5], [10] or [20].

(5) Bring the meter indication to the desired value by turning the [1 kHz OR EXT] knob of the [MOD RATE]. Measure the frequency deviation in this state with the FM linear detector and calculate the error by using the equation shown in (3).

(6) Conduct the test for each frequency range and verify that the error is within $\pm 10\%$ of the full scale value.

20 kHz range	20 kHz	18 kHz to 22 kHz
	10 kHz	8 kHz to 12 kHz
10 kHz range	10 kHz	9 kHz to 11 kHz
	5 kHz	4 kHz to 6 kHz
5 kHz range	5 kHz	4.5 kHz to 5.5 kHz
	3.5 kHz	3.0 kHz to 4.0 kHz
1 kHz range	1 kHz	0.9 kHz to 1.1 kHz
	0.5 kHz	0.4 kHz to 0.6 kHz

38

3.3.2.4 External modulation input level test*

Specification: 1 V rms or less at deviation of 20 kHz

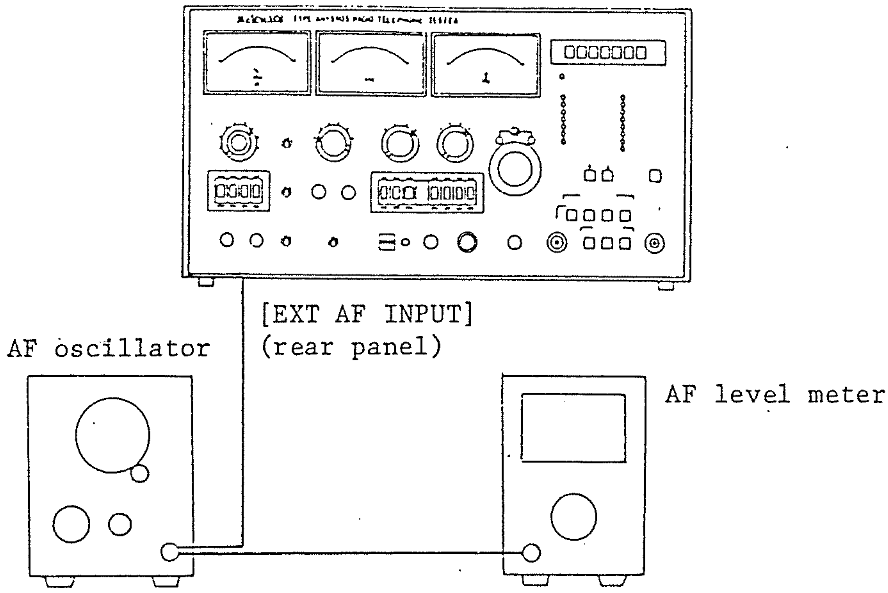


Fig. 3-7 External modulation input level test

(1) Connect a AF oscillator to the [EXT AF INPUT] terminal located on the rear panel of this apparatus as shown in Fig. 3-7.

(2) Set the controls of this apparatus as follows:

Test item	[AF INPUT LEVEL] of [RECEIVER TEST]
[MOD SELECT] switch	[EXT]
[1 kHz OR EXT] knob	Turn fully clockwise.
[DEVIATION kHz]	[20]
[RF FREQUENCY 25 ∿ 520 MHz]	Set as desired between 25 and 520 MHz.
Other controls	Any position

39

(3) Set the frequency of the AF oscillator to 1 kHz and bring the frequency deviation indication of this apparatus to 20 kHz by gradually raising the output level. Check the voltage shown by the AF level meter and verify that it does not exceed 1 V rms.

3.3.2.5 FM modulation distortion test*

Specification: 1% or less for ±3.5 kHz deviation

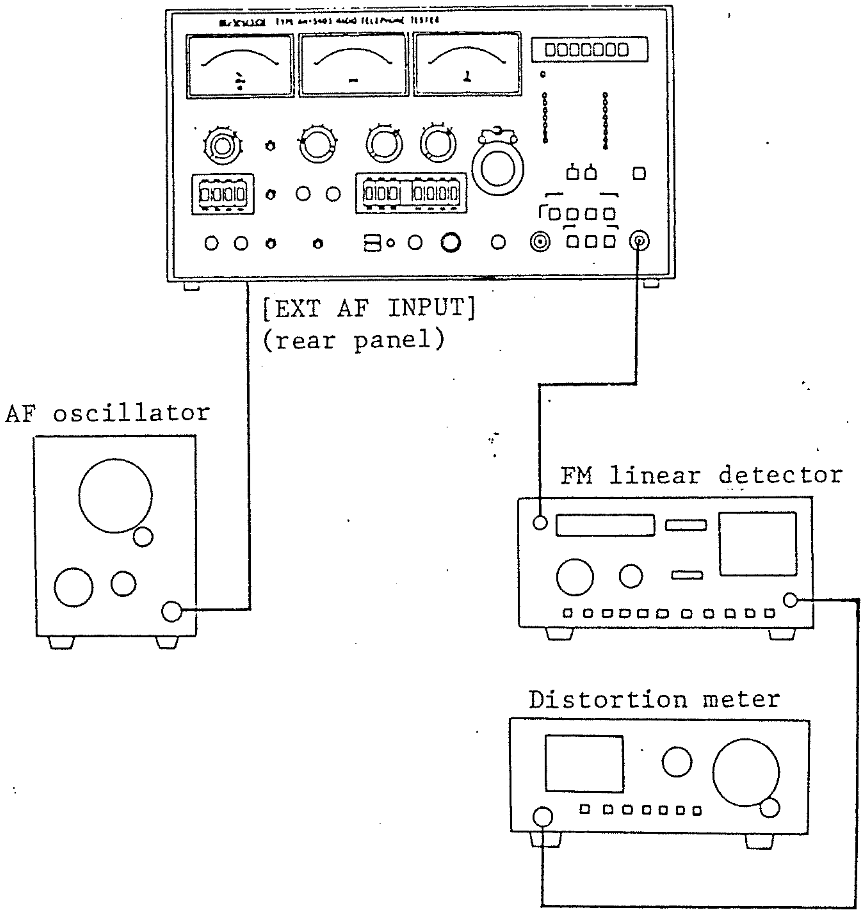


Fig. 3-8 FM modulation distortion rate test

(1) Connect an FM linear detector to the [RF INPUT/OUTPUT 50 Ω 25 W] connector of this apparatus as ahown in Fig. 3-8. Also, connect a AF oscillator to the [EXT AF INPUT] terminal located on the rear panel of the apparatus.

(2) Set the controls of this apparatus as follows:

Test item [AF INPUT LEVEL] of [RECEIVER TEST]

[OUTPUT LEVEL dBμ] dial [80]

[+1 ∿ -10 dBμ] knob [0 dBμ] (Output level meter indication)

[DEVIATION kHz] switch	[5]
[MOD SELECT] switch	[EXT]
[RF FREQUENCY 25 ∿ 520 MHz]	Set as desired between 25 and 520 MHz.
Other controls	Any position

(3) Adjust the output level of the AF oscillator and [1 kHz OR EXT] knob of this apparatus to bring the frequency deviation to 3.5 kHz.

(4) Measure the output signal distortion of the FM linear detector with the distortion meter and verify that it is 1% or less.

> NOTE
>
> Set the low frequency output band of the FM linear detector to be between 400 Hz and 3 kHz so as to cut the low and high frequency noise components.

42

3.3.2.6 Signal to noise ratio test*

Specification: 42 dB or more for a demodulation band of 400 Hz to 3 kHz and a deviation of ±3.5 kHz

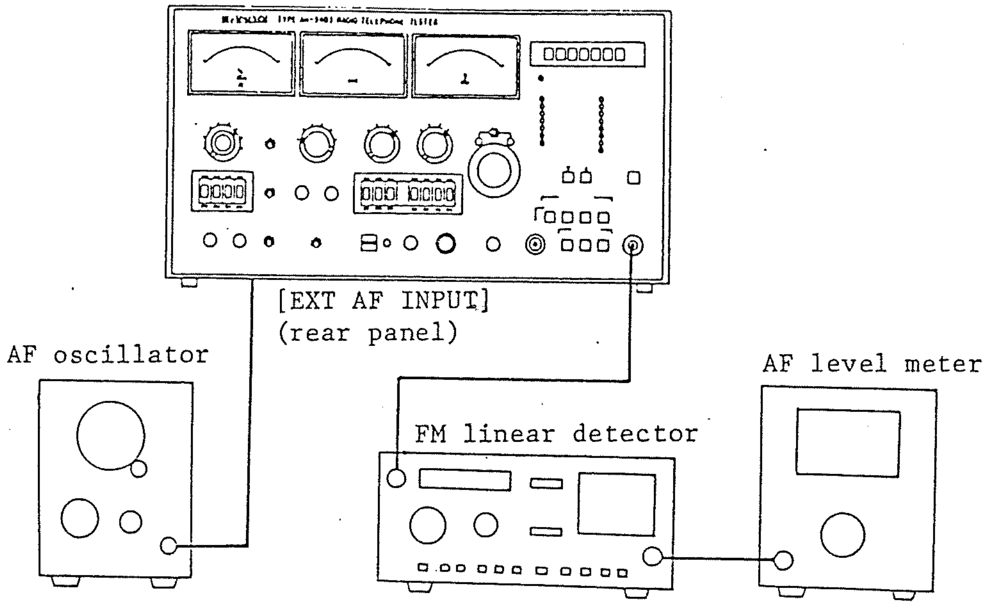


Fig. 3-9 Signal to noise ratio test

(1) Connect an FM linear detector to the [RF INPUT/OUTPUT 50 Ω MAX. 50 Ω] connector of this apparatus as shown in Fig. 3-9. Also, connect an AF oscillator to the [EXT AF INPUT] terminal located on the rear panel of the apparatus.

(2) Set the controls of this apparatus as follows:

Test item	[AF INPUT LEVEL] of [RECEIVER TEST]
[OUTPUT LEVEL dBμ] dial	[80]
[+1 ∿ -10 dBμ] knob	[0 dBμ] (Output level meter indication)
[DEVIATION kHz] switch	[5]
[MOD SELECT] switch	[EXT]
[1 kHz OR EXT] knob	Place at about the center position.

43

[RF FREQUENCY 25 ∿ 520 MHz]	Set as desired between 25 and 520 MHz.
Other controls	Any position

(3) Adjust the output level (1 kHz) of the AF oscillator and [1 kHz OR EXT] knob of this apparatus to bring the deviation to ±3.5 kHz.

(4) Measure the output level SdB (signal level) of the FM linear detector with the AF level meter.

(5) As the test item, set the [S/N] of the [RECEIVER TEST] on this apparatus. Then, read the noise level NdB on the AF level meter.

(6) The (S - N) dB is the signal to noise ratio. Verify that it is 42 dB or more.

NOTE

(1) Set the low frequency output band of the FM linear detector to between 400 Hz and 3 kHz so as to cut the low and high frequency noise components.

(2) Setting the [MOD SELECT] switch to [1 kHz] makes it possible to perform the test using the 1 kHz signal generated in this apparatus without requiring the AF oscillator to be connected to the [EXT AF INPUT] terminal (rear panel).

44

3.3.3 RF Wattmeter

3.3.3.1 Scale accuracy test

Specification: Within ±10% of full scale for each of four ranges, 1.5/7.5/15/30 W

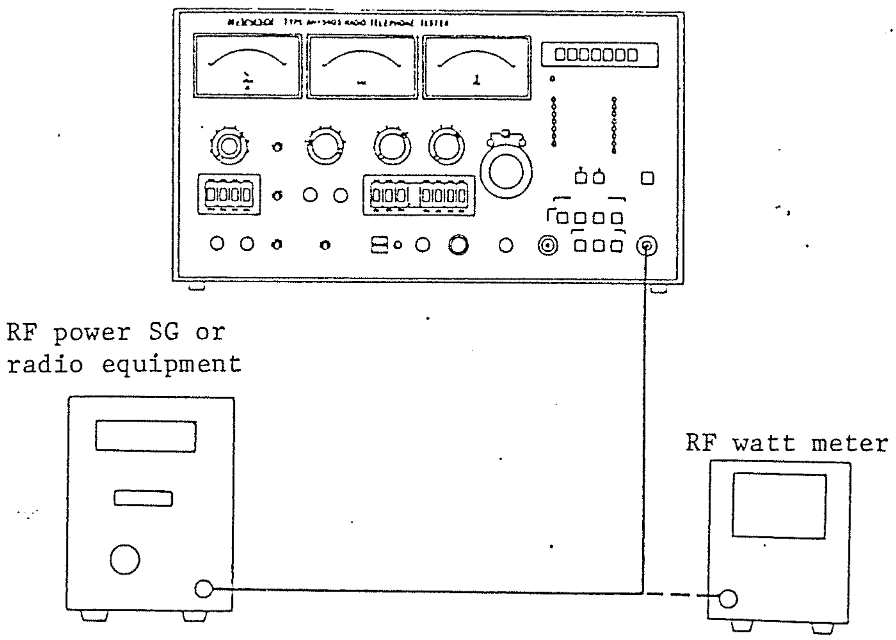


Fig. 3-10 Scale accuracy test (RF wattmeter)

(1) Connect a 25 to 520 MHz RF power SG or radio equipment to the [RF INPUT/OUTPUT 50 Ω MAX. 50 Ω] connector of this apparatus as shown in Fig. 3-10.

(2) Set the controls of this apparatus as follows:

Test item	[AF LEVEL SET] of [TRANSMITTER TEST]
[RF POWER W] switch	[30]
Other controls	Any position

(3) Adjust a output level of RF power SG or radio equipment and bring the meter indication of this apparatus to the desired RF power.

45

Then, read the RF power shown on the meter of the RF wattmeter and calculate the error by using the following equation:

$$\text{Error} = \frac{\text{Measured value - Meter indication}}{\text{Full scale value}} \times 100\ (\%)$$

(4) Conduct the test for 25, 250 and 520 MHz.

(5) Conduct the test for all four ranges, 1.5, 7.5, 15 and 30 W.

(6) The errors allowable for each range are as follows:

30 W range	30 W 20 W 10 W	27 to 33 W 17 to 23 W 7 to 13 W	(±3 W)
15 W range	15 W 10 W 5 W	13.5 to 16.5 W 8.5 to 11.5 W 3.5 to 6.5 W	(±1.5 W)
7.5 W range	5 W	4.25 to 5.75 W	(±0.75 W)
1.5 W range	1 W	0.85 to 1.15 W	(±0.15 W)

46

3.3.4 FM Linear Detector

3.3.4.1 Frequency deviation meter accuracy test

Specification: Within $\pm$10% of full scale

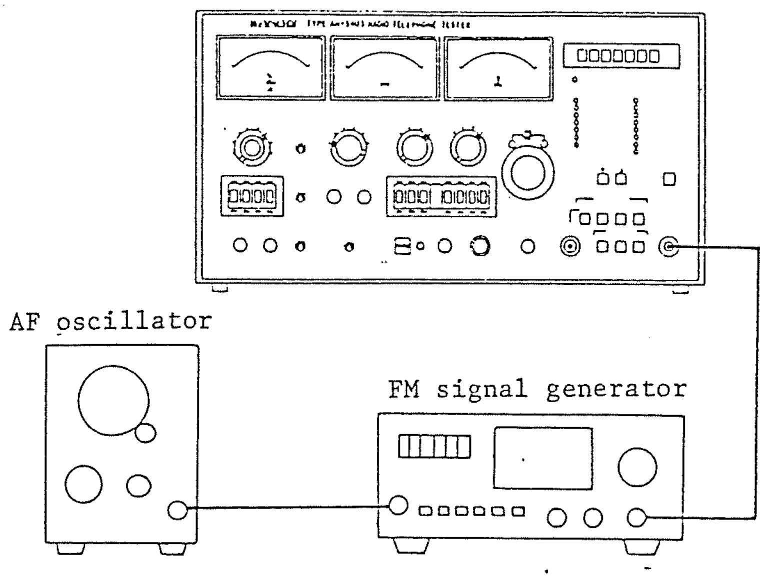


Fig. 3-11 Frequency deviation meter accuracy test

(1) Connect an FM signal generator to the [RF INPUT/OUTPUT 50 Ω MAX. 25 W] connector of this apparatus as shown in Fig. 3-11.

(2) Set the controls of this apparatus as follows:

Test item	[AF LEVEL SET] of [TRANSMITTER TEST]
[DEVIATION kHz] switch	[20]
[LEVEL dBm DISTORTION % dB] switch	[100]
[100% SET] switch	[+20 dB]
[RF FREQUENCY 25 ∿ 520 MHz]	Set as desired between 25 and 520 MHz
Other controls	Any position

47

(3) Apply a 1 kHz modulation signal to the FM signal generator and bring the meter indication of this apparatus to the desired frequency deviation. Then, read the frequency deviation shown on the meter of the signal generator and calculate the error by using the following equation:

$$\text{Error} = \frac{\text{Measured value} - \text{Meter indication}}{\text{Full scale value}} \times 100\ (\%)$$

(4) Measure the frequency deviation errors in each range and verify that each error is within ±10% of the full scale.

> NOTE
>
> Since the 1 kHz/full scale range is for measuring the CTCSS tone signal frequency deviation, its demodulation band is set to be 30 Hz to 400 Hz. For correct measurement, always set the modulation frequency to 150 Hz.

20 kHz range	20 kHz 10 kHz	18 kHz to 22 kHz 8 kHz to 12 kHz
10 kHz range	10 kHz 5 kHz	9 kHz to 11 kHz 4 kHz to 6 kHz
5 kHz range	5 kHz 3.5 kHz	4.5 kHz to 5.5 kHz 3.0 kHz to 4.0 kHz
1 kHz range	1 kHz 0.5 kHz	0.9 kHz to 1.1 kHz 0.4 kHz to 0.6 kHz

NOTE

To cause the red LED [FM DEMO OPERATION] of the linear detector to light, an input level of 100 mW (+20 dBm) or more is required. However, normal operation is possible with an input level of 1 mW (0 dBm) or more even if the red LED is not illuminated.

NOTE

The frequency response can be checked by conducting measurement while varying the modulation frequency.

3.3.4.2 Demodulation distortion test*

Specification: 1% or less at a deviation of ±3.5 kHz

(1) Connect an FM signal generator to the [RF INPUT/OUTPUT 50 Ω MAX. 25 W] connector of this apparatus as shown in Fig. 3-12.

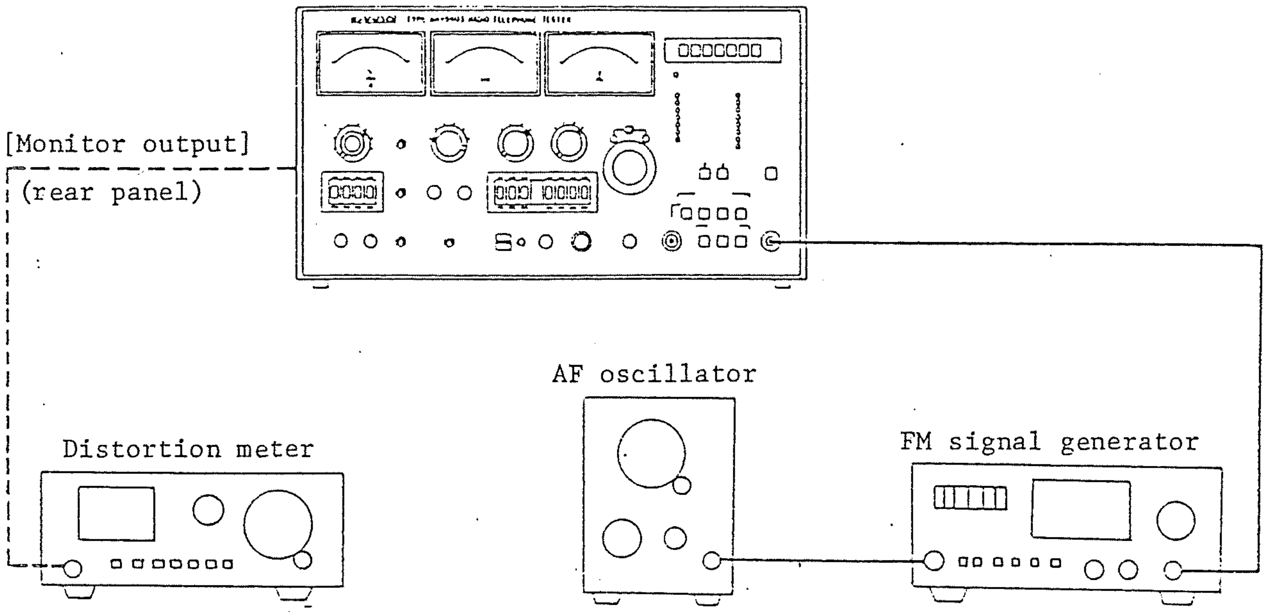


Fig. 3-12 Demodulation distortion test

(2) Set the controls of this apparatus as follows:

Test item	[AF LEVEL SET] of [TRANSMITTER TEST]
[DEVIATION kHz] switch	[5]
[AF BW] switch	[400 Hz ∿ 3 kHz]
[100% SET] switch	[0 dB]
[LEVEL dBm DISTORTION % dB] switch	[100]
[RF FREQUENCY 25 ∿ 520 MHz]	Set as desired between 25 and 520 MHz
Other controls	Any position

50

(3) Apply a 1 kHz (±10 Hz) modulation signal to the FM signal generator and cause frequency modulation with a deviation of ±3.5 kHz. Set the FR frequency to be the same as the receiving frequency of this apparatus.

(4) After making sure that the deviation meter of this apparatus reads 3.5 kHz, bring the level meter indication to the 100% full scale point by adjusting the control knob attached to the [LEVEL dBm DISTORTION % dB] switch.

(5) Set the [DISTORTION] of the [TRANSMITTER TEST] as test item and measure the distortion with the level meter gradually enhancing the sensitivity by turning the [LEVEL dBm DISTORTION % dB] switch counterclockwise.

(6) Verify that the distortion obtained is 1% or less.

> NOTE
>
> Connecting a distortion meter to the [MONITOR OUTPUT] terminal located on the rear panel of this apparatus makes it possible to measure the distortion by using a modulation frequency of other than 1 kHz. In that case, set the controls to be the same as described in (2).

> NOTE
>
> To cause the red LED [FM DEMO OPERATION] to light, an input level of 100 mW (+20 dBm) or more is required. However, normal operation is possible with an input level of 1 mW (0 dBm) or more even if the red LED is not illuminated.

41

3.3.4.3 Demodulation signal to noise ratio test*

Specification: 42 dB or more for a demodulation band of 400 Hz to 3 kHz and a deviation of ±3.5 kHz

(1) Connect an FM signal generator to the [RF INPUT/OUTPUT 50 Ω MAX. 25 W] connector of this apparatus as shown in Fig.-3-13.

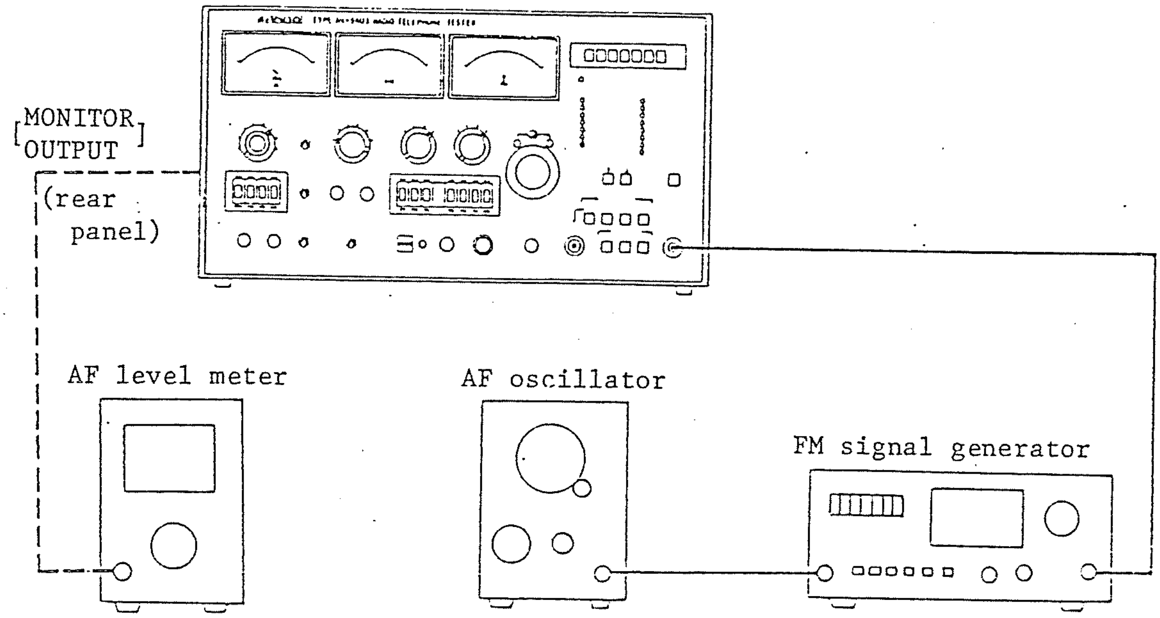


Fig. 3-13 Demodulation signal to noise ratio test

(2) Set the controls of this apparatus as follows:

Test item	[AF LEVEL SET] of [TRANSMITTER TEST]
[DEVIATION kHz] switch	[5]
[AF BW] switch	[400 Hz ∿ 3 kHz]
[100% SET] switch	[0 dB]
[LEVEL dBm DISTORTION % dB] switch	[100]
[RF FREQUENCY 25 ∿ 520 MHz]	Set as desired between 25 and 520 MHz.
Other controls	Any position

52

(3) Apply a 1 kHz (±10 Hz) modulation signal to the FM signal generator to cause frequency modulation with a deviation of ±3.5 kHz. Set the RF frequency to be the same as the receiving frequency of this apparatus.

(4) After making sure that the deviation meter of this apparatus reads 3.5 kHz, bring the level meter indication to the 100% full scale point by adjusting the control knob attached to the [LEVEL dBm DISTORTION % dB] switch.

(5) Turn off modulation on the FM signal generator and measure the noise level gradually enhancing the sensitivity by turning the [LEVEL dBm DISTORTION % dB] switch counterclockwise.

(6) Verify that the S/N ratio measured is 42 dB or more.

NOTE

The test can be conducted also by connecting a AF level meter to the [MONITOR OUTPUT] terminal located on the rear panel of this apparatus. In that case, the controls must be set to be the same as described in (2).

NOTE

To cause the red LED [FM DEMO OPERATION] to light, an input level of 100 mW (+20 dBm) or more is required. However, normal operation is possible with an input level of 1 mW (0 dBm) or more even if the red LED is not illuminated.

63

3.3.5 AF Signal Output

3.3.5.1 Output frequency test

Specification: 1 kHz

(1) Connect a frequency counter to the AF output terminal of the [TO TRANSCEIVER] mike connector of this apparatus as shown in Fig. 3-14.

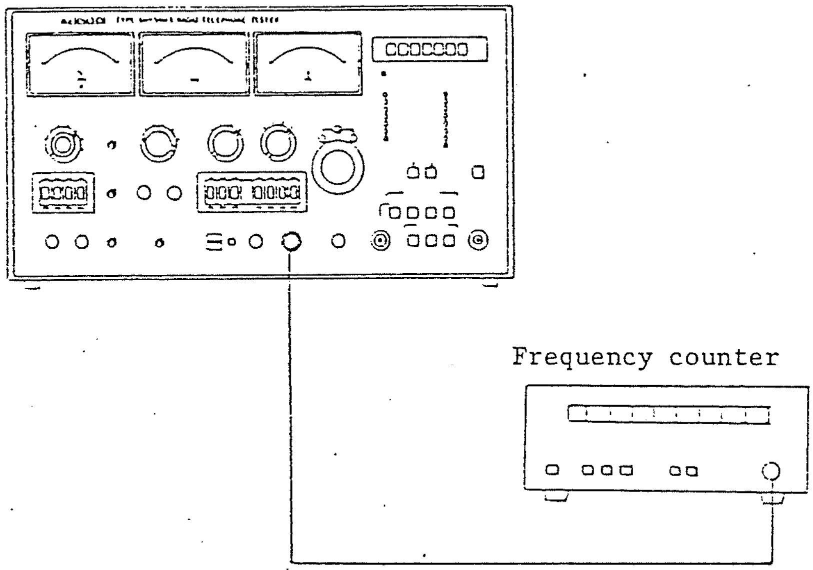


Fig. 3-14 AF signal output frequency test

NOTE : The mike connector terminal layout is shown in Fig. 3-15.

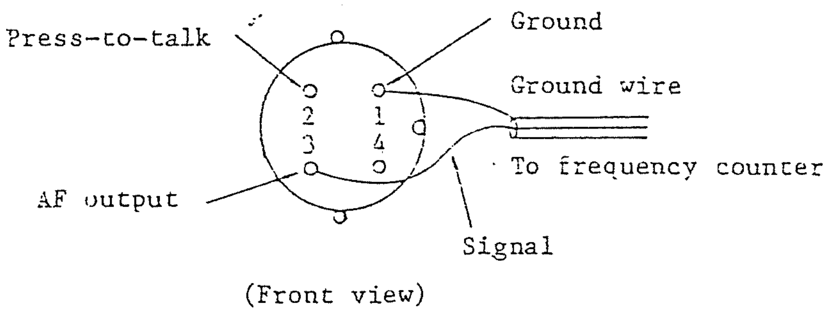


Fig. 3-15 Mike connector connections

54

(2) Set the controls of this apparatus as follows:

Test item	[AUDIO SENSITIVITY] of [TRANSMITTER TEST]
[MOD SELECT] switch	[1 kHz]
[LEVEL] knob of the mike connector	Pulling the knob, turn it and place it at about the center position.
[LEVEL dBm DISTORITON % dB] switch	[+10]
Other controls	Any position

(3) Count the AF output frequency with the frequency counter and verify that the count is within 1,000 Hz ±0.1 Hz.

3.3.5.2 Output level test*

Specification: From within +5 ±1 dBm to -50 dBm or less (for 600 Ω resistive load)

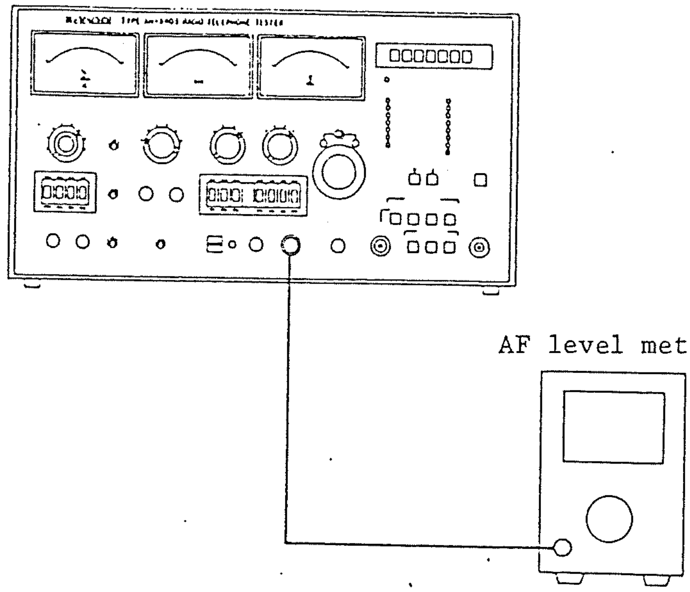


Fig. 3-16 Low frequency output level test

(1) Connect an AF level meter terminated in 600 Ω to the AF output terminal of the [TO TRANSCEIVER] mike connector of this apparatus as shown in Fig. 3-16. For the mike connector terminal layout, see Fig. 3-15.

(2) Set the controls of this apparatus as follows:

Test item	[AUDIO SENSITIVITY] of [TRANSMITTER TEST]
[MOD SELECT] switch	[1 kHz]
[LEVEL dBm DISTORTION % dB] switch	[+10]
Other controls	Any position

56

(3) Pulling out the [LEVEL] knob of the mike connector, turn it fully clockwise and then measure the output level. Verify that the output level is within +5 dBm ± 1 dBm.

(4) Next, pushing the LEVEL knob of the mike connector, turn it fully counterclockwise and then measure the output level. Verify that the output level is -50 dBm or less.

57

3.3.5.3 Output distortion test*

Specification: 0.3% or less

(1) Connect a distortion meter to the AF output terminal of the [TO TRANSCEIVER] mike connector of this apparatus as shown in Fig. 3-17. The terminal layout of the mike connector is as shown in Fig. 3-15. Set the input impedance of the distortion meter to 600 Ω.

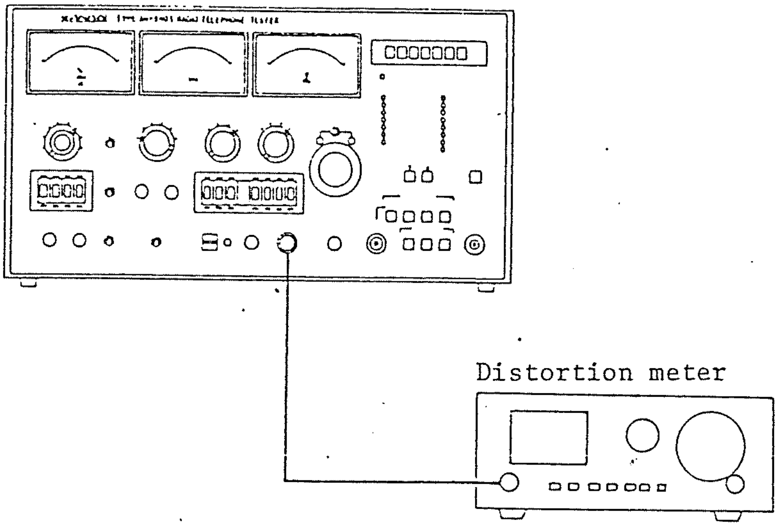


Fig. 3-17 Output distortion test

(2) Set the controls of this apparatus as follows:

Test item	[AUDIO SENSITIVITY] of [TRANSMITTER TEST]
[MOD SELECT] switch	[1 kHz]
[LEVEL dBm DISTORITON % dB] switch	[+10]
[LEVEL] knob of the mike connector	Pulling the knob, turn it fully clockwise. (Set the output level to the maximum.)
Other controls	Any position

(3) Measure the distortion with the distortion meter and verify that the distortion is 0.3% or less.

58

3.3.6 AF Level Meter and Distortion Meter

3.3.6.1 Scale accuracy test

Specification: Within ± 1 dB

(1) Connect a AF oscillator to the [INPUT] terminal of the [AF LEVEL METER] of this apparatus as shown in Fig. 3-18.

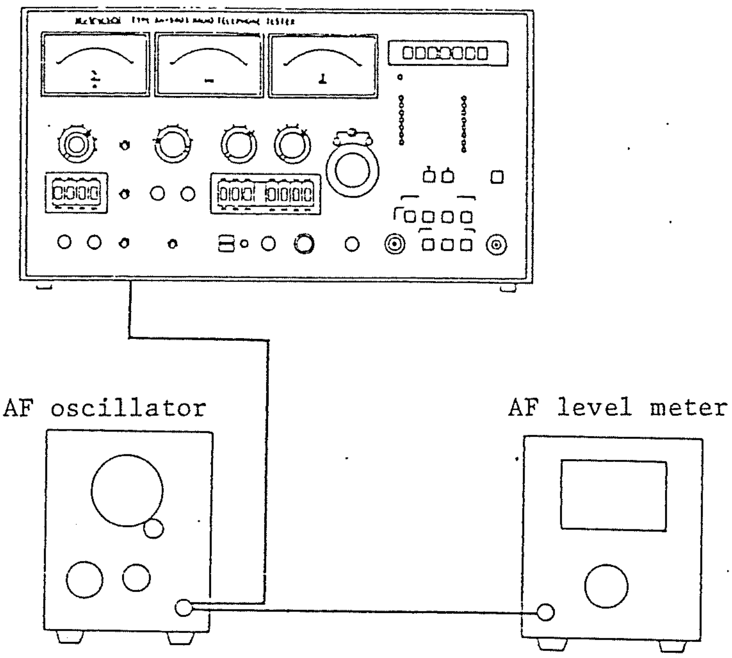


Fig. 3-18 Scale accuracy test

(2) Set the controls of this apparatus as follows:

Test item	[AF INPUT LEVEL] of [RECEIVER TEST]
[AF BW] switch	[30 Hz ∿ 3 kHz] (The frequency range of the AF level meter is from 30 Hz to 10 kHz.)
[AF LEVEL METER] switch	[600 Ω]
[LEVEL dBm DISTORTION % dB] switch	[+20 dBm]
Other controls	Any position

59

(3) Set the AF oscillator to 1 kHz and bring the level meter indication of this apparatus to the desired frequency. In this state, measure the output level of the AF oscillator and verify that the scale accuracy is within ± 1 dB.

> NOTE
>
> The frequency response can be checked by varying the frequency in the range of 30 Hz to 10 kHz. The range error can be checked by varying the level.

60

3.3.6.2 Distortion meter test*

Specification: Fundamental wave elimination rate is to be 50 dB or more at 1 kHz $\pm$10 Hz. (It must be possible to measure a distortion of 0.3%.)

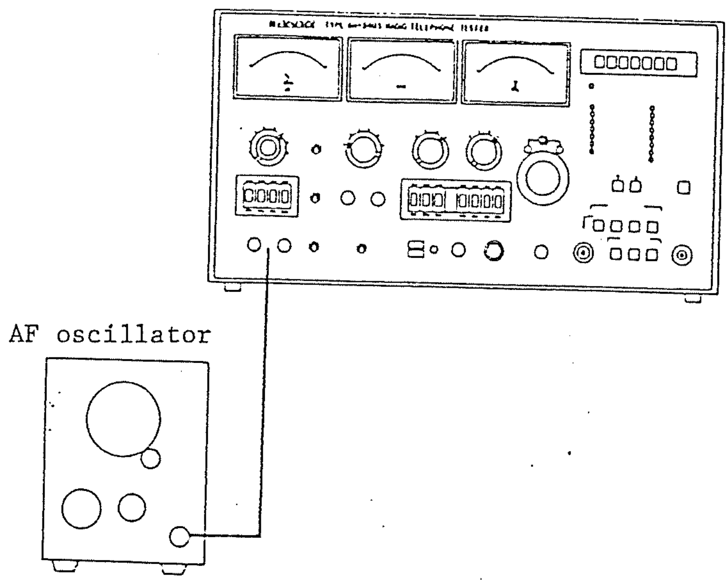


Fig. 3-19 Distortion meter test

(1) Connect a AF oscillator to the [INPUT] terminal of the [AF LEVEL METER] of this apparatus as shown in Fig. 3-19.

(2) Set the controls of this apparatus as follows:

· Test item	[AF LEVEL SET] of [RECEIVER TEST]
[AF BW] switch	[30 Hz ∿ 3 kHz] (The frequency range of the AF level meter is from 30 Hz to 10 kHz.)
[AF LEVEL METER] switch	[600 Ω]
[100% SET]	[0 dB]
[LEVEL dBm DISTORTION % dB] switch	[100]
Other controls	Any position

61

(3) Set the AF oscillator to 1 kHz ±10 Hz and bring the level to 0 dBm (0.775 V rms).

(4) Bring the distortion meter indication to the 100% point by adjusting the [LEVEL dBm DISTORTION % dB] knob.

(5) Next, set the [DISTORTION] of the [RECEIVER TEST] as test item and the fundamental wave will be eliminated. Then, turn the [LEVEL dBm DISTORTION % dB] switch and verify that a distortion attenuation of -50 dB or less (0.3%) can be measured.

NOTE
The distortion of the AF oscillator is to be 0.1 % or less.

62

3.3.7 AF Oscillator

3.3.7.1 Output frequency range test*

Specification: 50.0 to 299.9 Hz, synthesized in 0.1 Hz steps

50 to 2999 Hz, synthesized in 1 Hz steps

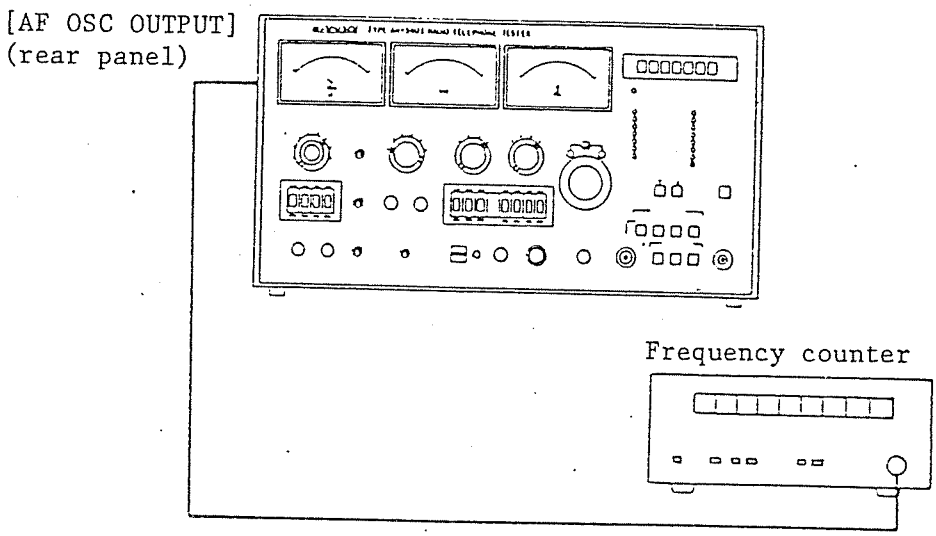


Fig. 3-20 Output frequency range test

(1) Connect a frequency counter to the [OUTPUT] connector of the [AF OSC] located on the rear panel of this apparatus as shown in Fig. 3-20.

(2) For this test, the controls of this apparatus may be at any positions.

(3) Place the [LEVEL] knob of the [AF OSC] located on the rear panel at about the center position.

(4) Set the [AF OSCILLATOR 50 ∿ 2999 Hz] to [2999] and the [FREQUENCY RANGE] to [x1]. Then, count the frequency with the frequency counter and verify that the error is within ±0.1 Hz. Repeat the same after setting the [FREQUENCY RANGE] to [x0.1].

3.3.7.2 Output level test

Specification: From +5 ± 1 dBm to -30 dBm or less

(For 600 Ω resistive load)

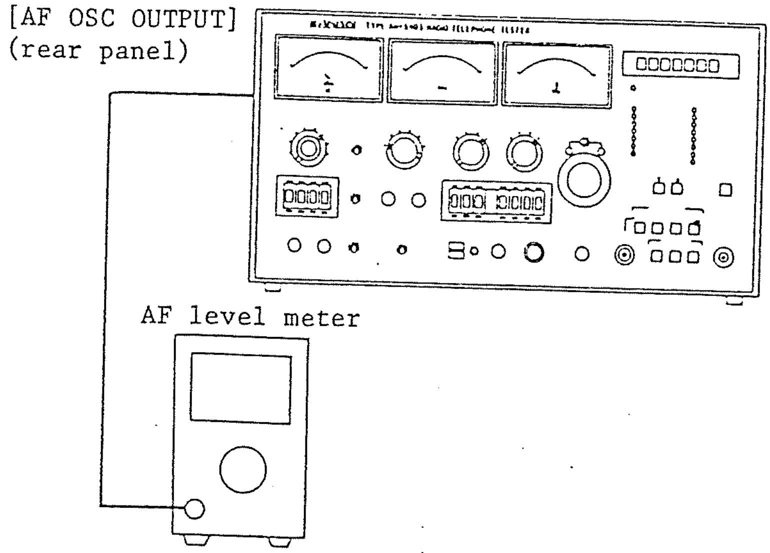


Fig. 3-21 Output level test

(1) Connect an AF level meter to the [OUTPUT] connector of the [AF OSC] located on the rear panel of this apparatus as shown in Fig. 3-21. Terminate the input to the AF level meter in 600 Ω.

(2) The controls of this apparatus may be at any positions, but note that the setting of the [AF OSCILLATOR 50 ∿ 2999 Hz] must be between 50 and 2999 Hz.

(3) Turn the [LEVEL] knob of the [AF OSC] located on the rear panel of this apparatus fully clockwise. Then, read the output level on the AF level meter and verify that it is within +5 ± 1 dBm.

(4) Turn the [LEVEL] knob fully counterclockwise. Read the output level and verify that it is -30 dBm or less.

64

3.3.8 Frequency Counter

3.3.8.1 Frequency accuracy test*

Specification: Within $\pm(0.1 \times 10^{-6} + 1$ count)

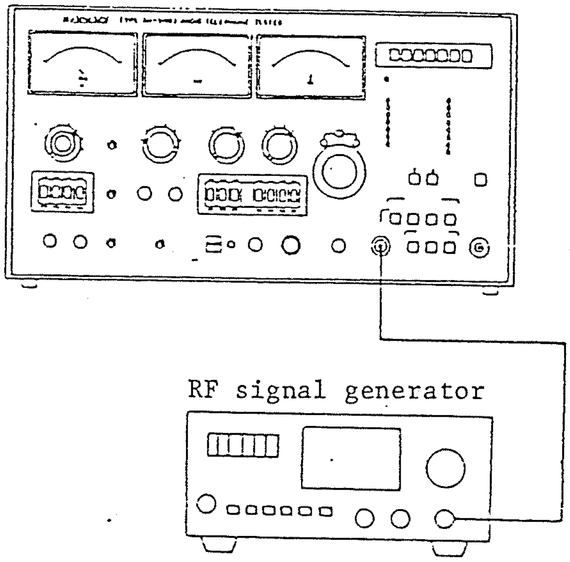


Fig. 3-22 Frequency accuracy test

(1) Connect a RF signal generator to the [EXT INPUT] connector of frequency counter of this apparatus as shown in Fig. 3-22.

(2) Set the controls of this apparatus as follows:

Test item	[OUTPUT (REAR)] of [TRANSMITTER TEST]
[INPUT SELECT] switch	[EXT], [50 ∿ 520 MHz]
[RESOLUTION] switch	[10 m/10/100 Hz]
Other controls	Any position

(3) Set the freqeuncy of the RF signal generator to 100 MHz and the output level to 0 dBm (0.225 V rms).

(4) Count the frequency with the frequency counter of this apparatus and verify that the counter reading is within the following range:

100.0001 MHz______________99.9999 MHz

> NOTE
>
> Prepare a RF signal generator with a frequency accuracy of 0.01×10^{-6} or less.

66

3.3.8.2 Input level sensitivity test*

Specification: 20 mV rms or less

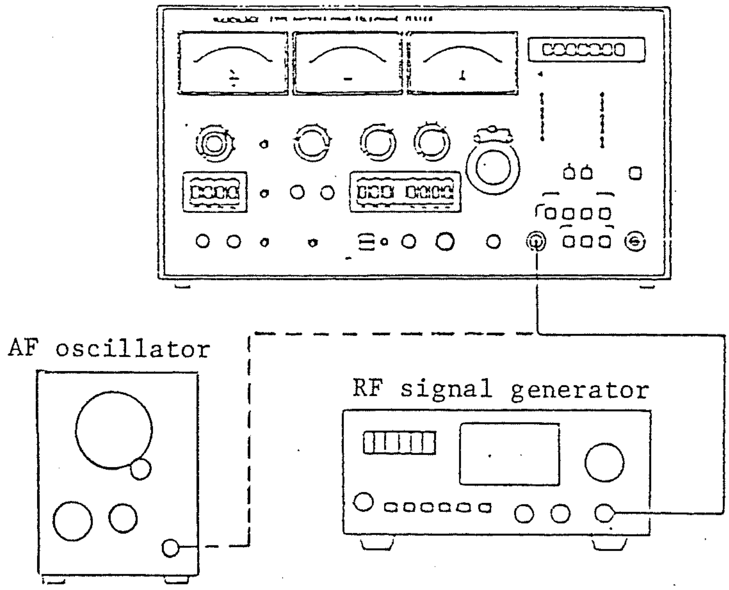


Fig. 3-23 Input level sensitivity test

(1) Connect a RF signal generator to the [EXT INPUT] connector of frequency counter of this apparatus as shown in Fig. 3-23.

(2) Set the controls of this apparatus as follows:

Test item	[OUTPUT (REAR)] of [TRANSMITTER TEST]
[INPUT SELECT] switch	[EXT], [50 ∿ 520 MHz]
[RESOLUTION] switch	[10 m/10/100 Hz]
Other controls	Any position

(3) Verify that the frequency counter operate with a level of 20 mV rms or less at frequency in the range of 50 to 520 MHz.

(4) Next, set the [INPUT SELECT] switch to [10 Hz ∿ 50 MHz] and verify that the frequency counter operate with a level of 20 mV rms or less at frequency in the range of 10 Hz to 50 MHz.

Use of a RF signal generator or AF oscillator by measuring frequency range.

67

SECTION 4

CALIBRATION

4.1 INTRODUCTION

This section describes how to calibrate and adjust the apprartus. Besides when calibration becomes necessary, this apparatus should be calibrated at least once a year, preferably every six months. Before calibrating the apparatus as described in this section, conduct the performance test by using the procedures set forth in SECTION 3 and clarify the purpose of the calibration or adjustment. Also, it must be made sure that the error involved is not attributable to an external cause.

4.2 CONSTRUCTION OF APPARATUS (HOW TO REMOVE COVERS)

Before calibration or adjustment of the apparatus, its top and bottom covers must be removed as follows:

(1) Remove the four each of + screws that hold the top cover and the bottom cover.

(2) To remove the screws, use a driver fitting them so as not to damage their driver receiving grooves.

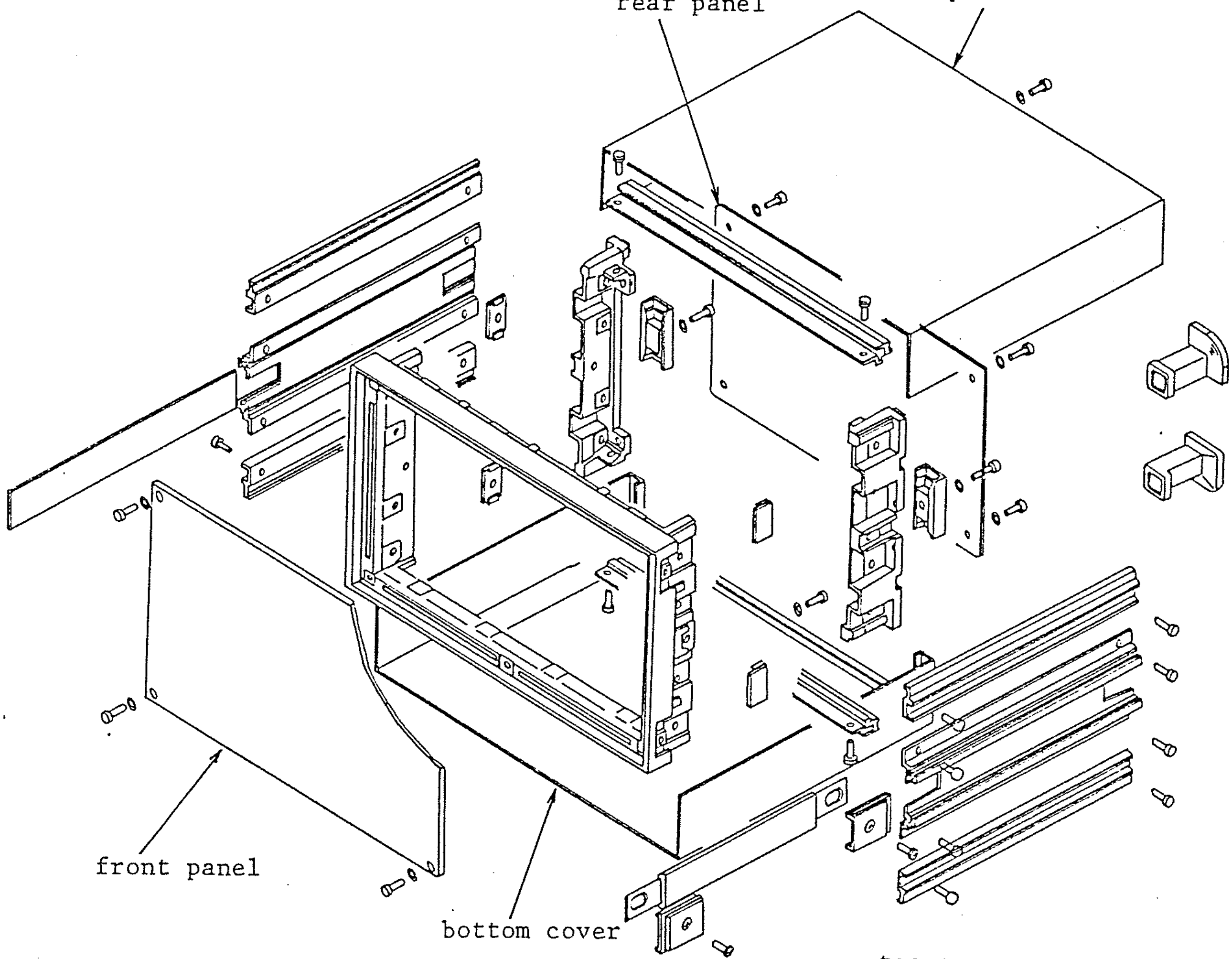
(3) When the screws are removed, each of the top and bottom covers can be lifted off.

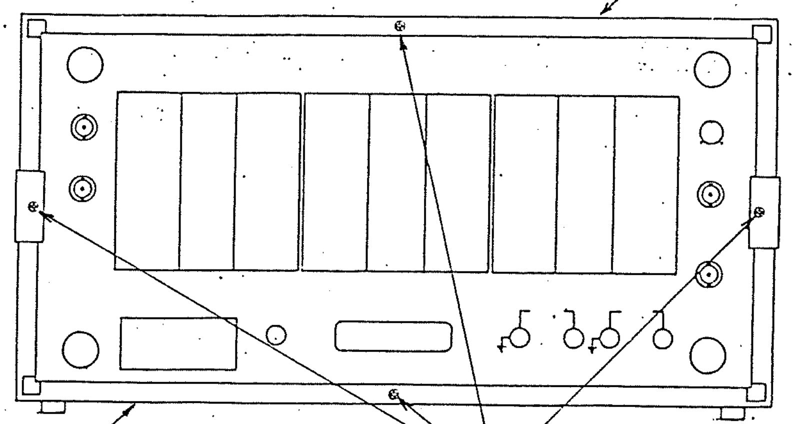
A disassembly drawing of the cabinet is shown in Fig. 4-1.

The top view of the apparatus with the top cover removed is shown in Fig. 4-2 and the bottom view without the bottom cover is shown in Fig. 4-3.

NOTE
Fig. 4-1 shows how to remove all covers, but do not remove other than the top and bottom covers.

Fig. 4-1


rear panel
top cover
front panel
bottom cover


top cover
bottom cover
Remove the four each of + screws

69

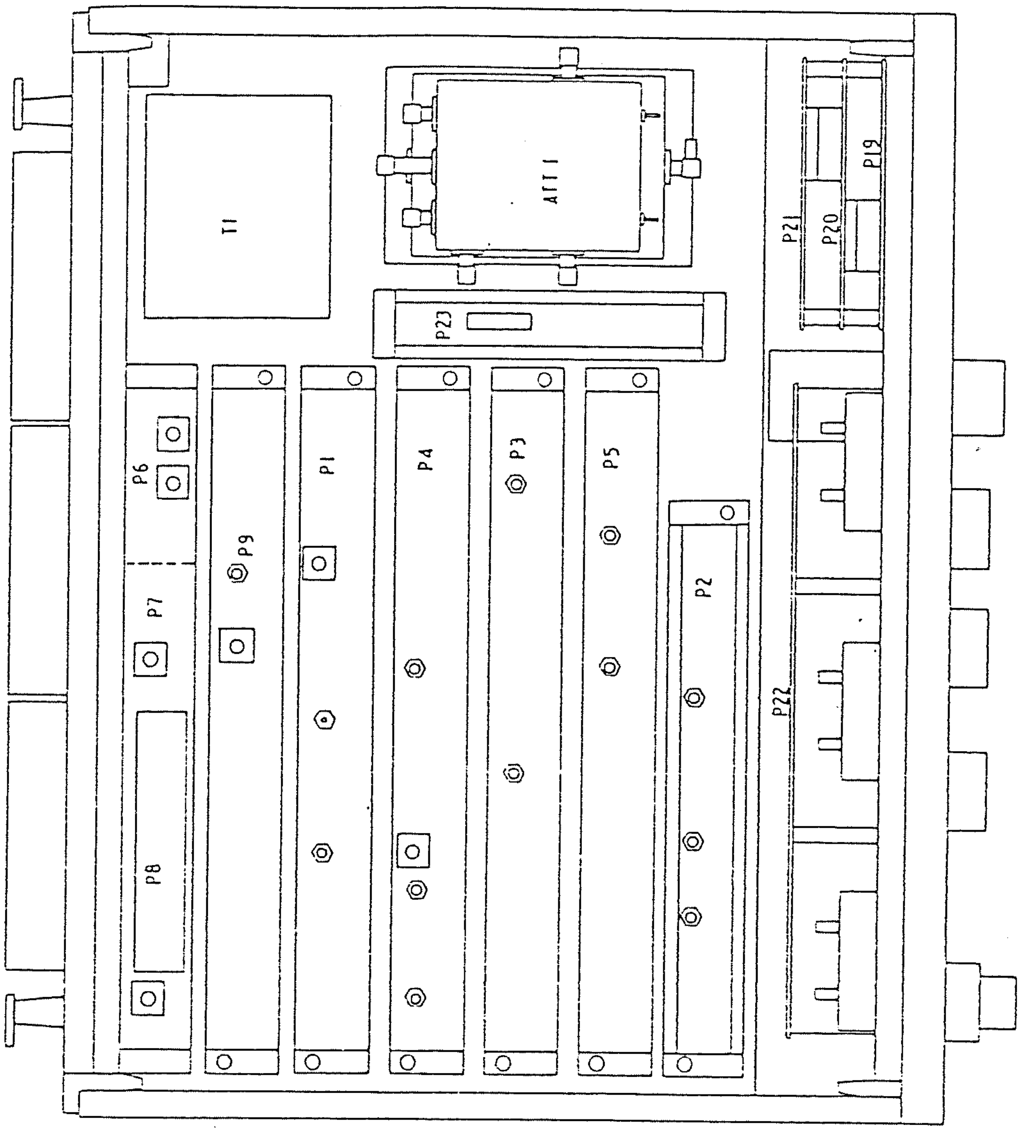


Fig. 4-2 Top view of apparatus without top cover

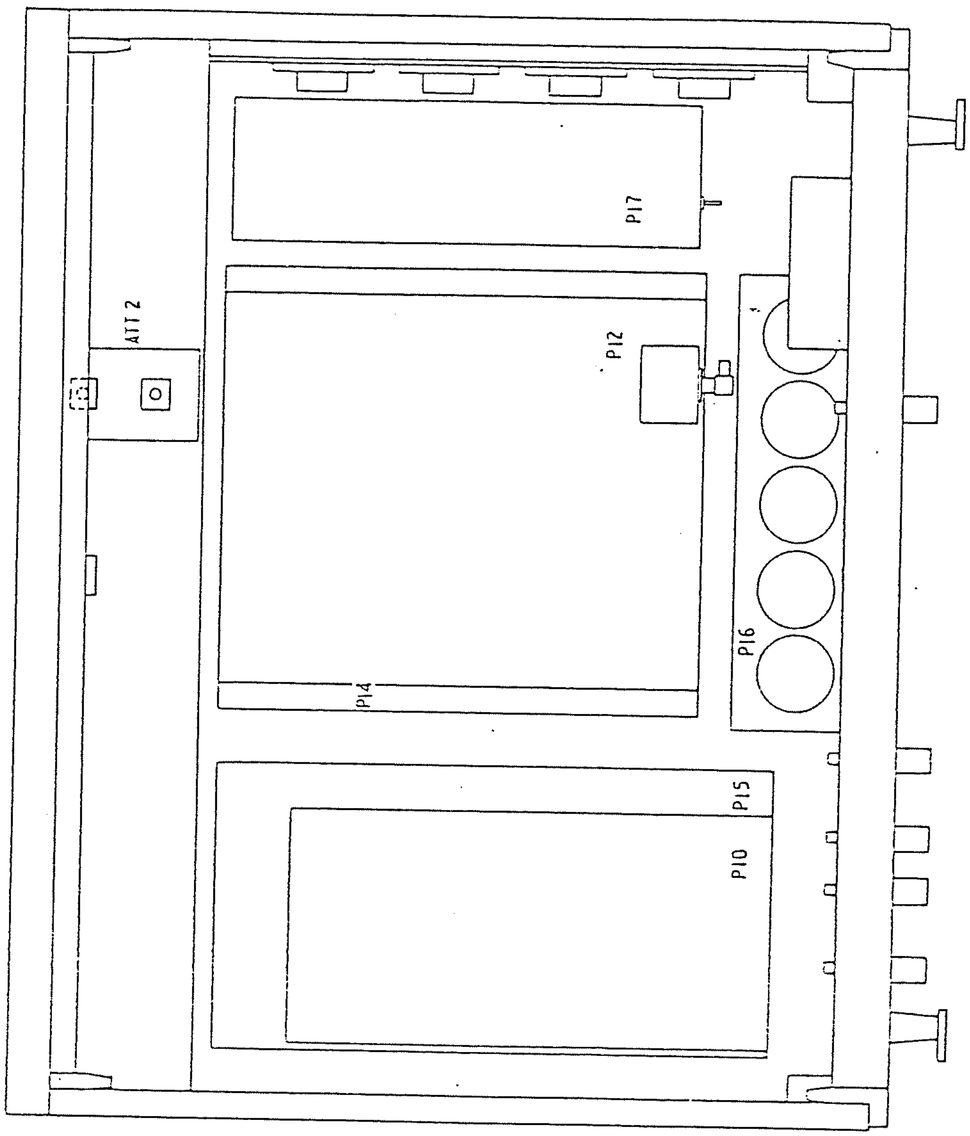


Fig. 4-3 Bottom view of apparatus without bottom cover

71

4.3 CALIBRATION

If, as a result of the performance test conducted as described in SECTION 3, the apparatus is found not satisfying the performance specifications, calibrate or adjust it using the procedures set forth in this subsection. If the calibration or adjustment to be carried out is not covered by this subsection, contact your local dealer since such calibration or adjustment must be done at the factory.

72

4.3.1 Calibration for Reference Frequency Accuracy

Calibration setup

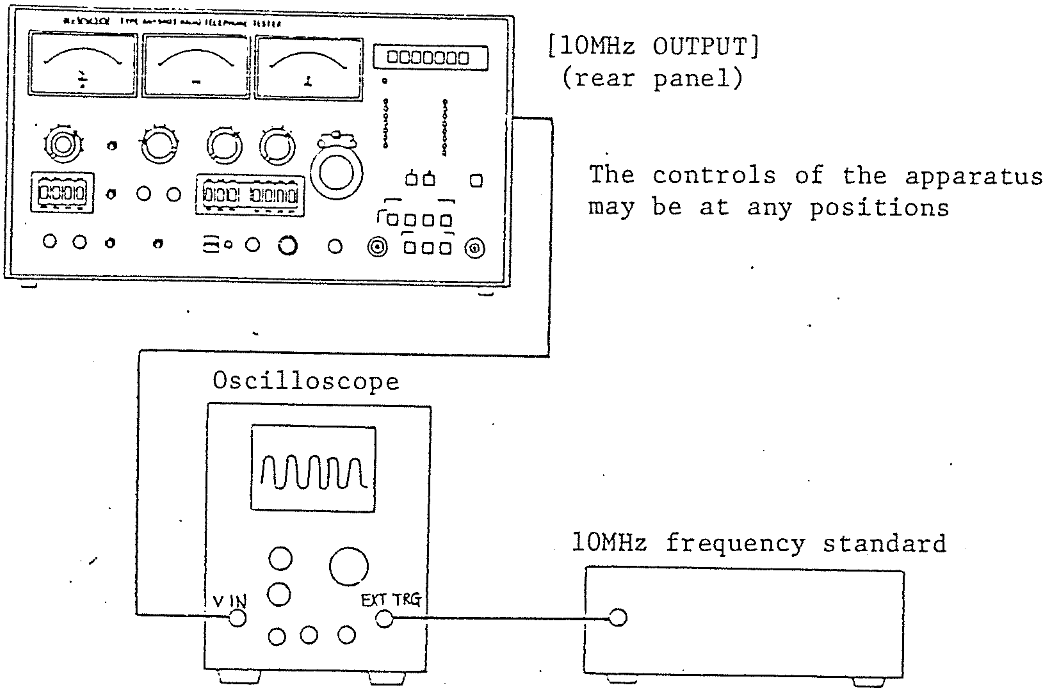


Fig. 4-4 Setup for calibration for reference frequency accuracy

Calibration procedure

(1) Warm up the apparatus for at least two hours in a room with a constant temperature (25°C ±2°C).

(2) Connect the cord leading from the oscilloscope to the [10 MHz OUTPUT] connector located on the rear panel of this apparatus. Apply a 10 MHz reference frequency signal to the vertical axis of the oscilloscope.

(3) Connect a 10 MHz frequency reference with an accuracy of $\pm 0.01 \times 10^{-6}$ to the external trigger connector.

(4) Properly adjust the waveform amplitude on the screen by adjusting the sweep time of the oscilloscope.

(5) Set the trigger switch of the oscilloscope to [EXT TRIG (external trigger)].

(6) If the frequency of the reference oscillator of this apparatus is not equal to the standard frequency, the waveform moves toward either side on the screen without being synchronized.

When, for example, the waveform shown on the screen moves left by a period portion per second, the reference frequency is 1 Hz higher ($+0.1 \times 10^{-6}$) than the standard frequency. If the waveform moves right by a period portion in ten seconds, the reference frequency is 0.1 Hz lower (-0.01×10^{-6}) than the standard frequency.

(7) By turning the OSC1 frequency adjuster in the circuit board unit 17 (PRE-100231), slow down the waveform movement on the screen so that a movement of a period portion takes a second or more.

The location of adjuster is shown in Fig. 4-5.

74

Adjuster for fine frequency adjustment

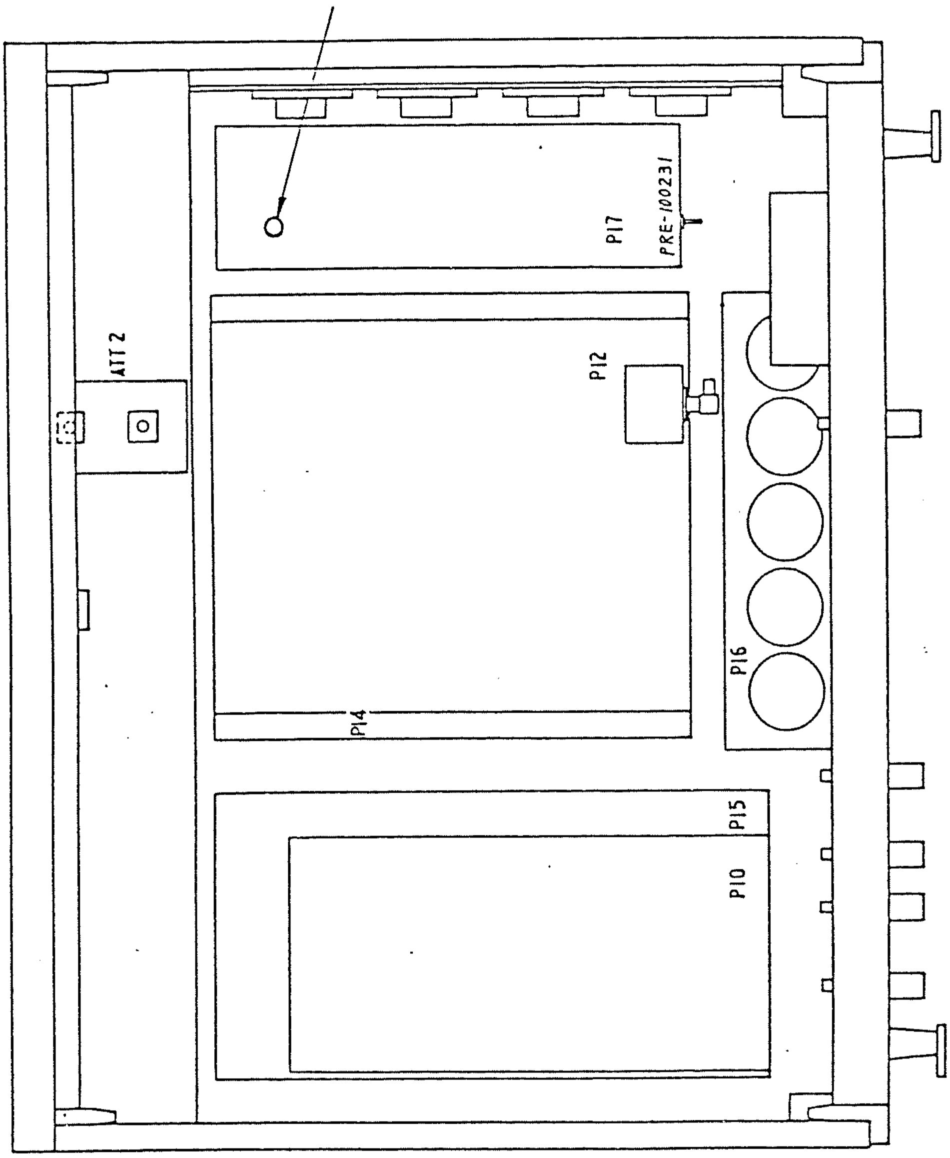


Fig. 4-5 Location of adjuster on P17 (PRE-100231) for calibration of the reference frequency of the synthesizer

75

4.3.2 RF Signal Generator

4.3.2.1 Calibration of the output level meter of signal generator

Calibration setup

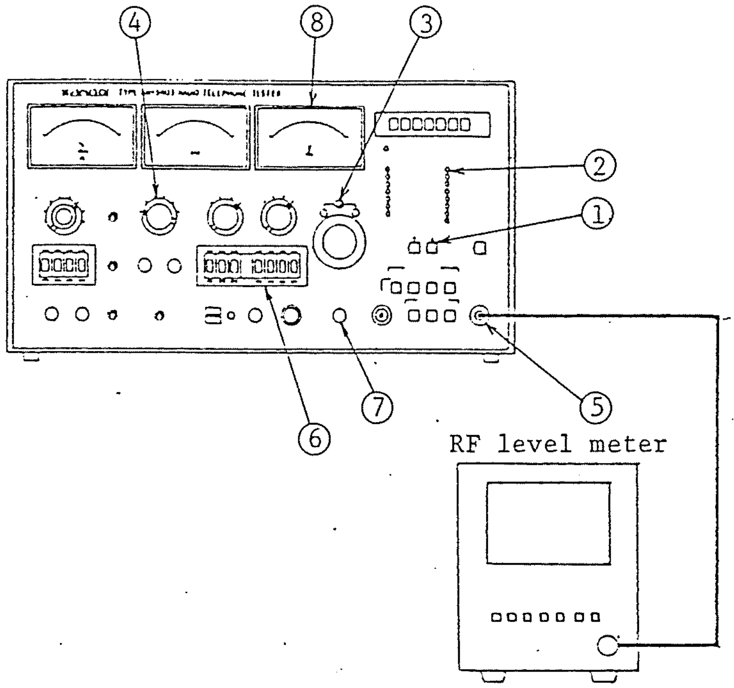


Fig. 4-6 Setup for calibration of the output level meter of signal generator

Calibration procedure

(1) As test item, set [AF INPUT LEVEL] ② by pressing the [▼] or [▲] button ①.

(2) Turn the [OUTPUT LEVEL dBμ] switch ③ to the left and set the output level to [80] by truning the dial fully clockwise.

(3) Set the [MOD SELECT] ④ to [OFF].

(4) Connect a RF level meter to the [RF INPUT/OUTPUT 50 Ω MAX. 25 W] ⑤.

76

(5) Set the [RF FREQUENCY 25 ∿ 520 MHz] switch ⑥ to [250.0000] MHz by pressing the frequency setting button $\boxed{+}$ or $\boxed{-}$.

(6) Bring the output level of this apparatus indicated on the RF level meter to 80 dB by adjusting the [+1 ∿ 10 dBμ] knob ⑦.

(7) Bring the indication of the output level meter ⑧ to [0 dBμ] by adjusting RV2 on circuit board unit P7 (PRE-200544). The location of RV2 is shown in Fig. 4-7.

77

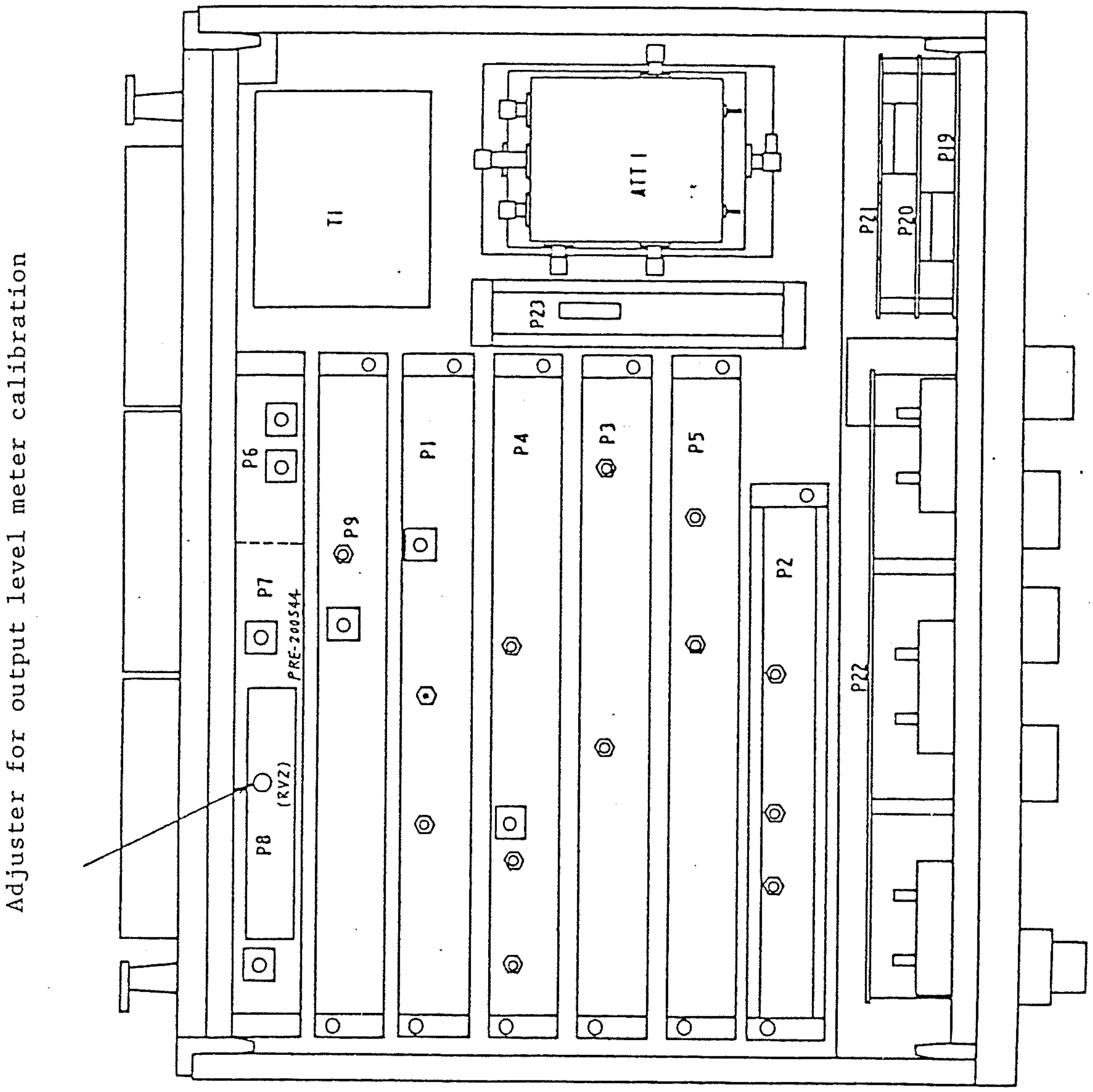


Fig. 4-7 Location of adjuster on P7 (PRE-200544) for calibration of the output level meter of the signal generator

4.3.2.2 Calibration of the deviation meter of signal generator

(1) Calibration using FM linear detector

Calibration setup

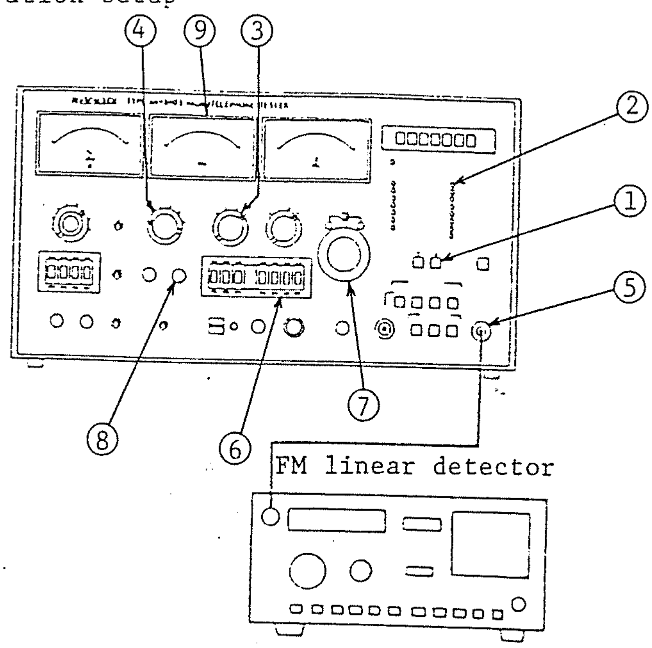


Fig. 4-8 Setup for calibration of the deviation meter of signal generator

Calibration procedure

(1) As test item, set [AF INPUT LEVEL] ② by pressing the [Y] or [⊥] button ①.

(2) Set the [DEVIATION kHz] range switch ③ to [5].

(3) Set the [MOD SELECT] switch ④ to the [OFF] position.

(4) Connect an FM linear detector to the [RF INPUT/OUTPUT 50 Ω MAX. 25 W] ⑤ and set the deviation measuring range of the FM linear detector to [5 ∿ 10 kHz].

(5) Set the [RF FREQUENCY 25 ∿ 520 MHz] ⑥ to [250.0000] and the [OUTPUT LEVEL dBu] dial ⑦ to [80], respectively.

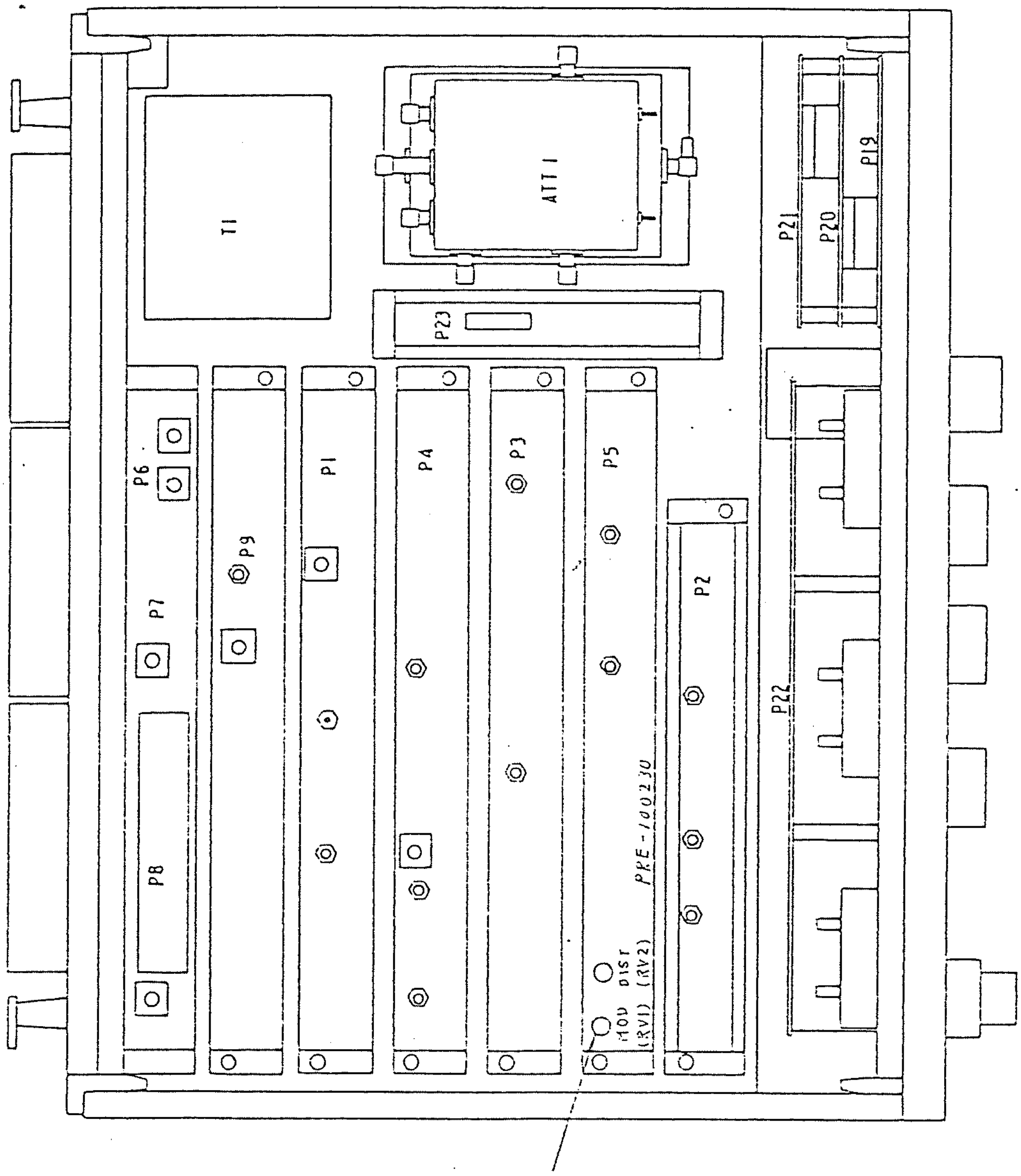
(6) Set the [MOD SELECT] switch ④ to [1 kHz].

79

(7) Bring the deviation meter indication of the FM linear detector to [5 kHz] by adjusting the [1 kHz OR EXT] knob (8).

(8) Bring the indication of the deviation meter (9) to 5 MHz by adjusting RV1 of circuit board unit P5 (PRE-100230).

The location of the RV1 to be adjusted is shown in Fig. 4-9.



Adjuster for deviation meter calibration

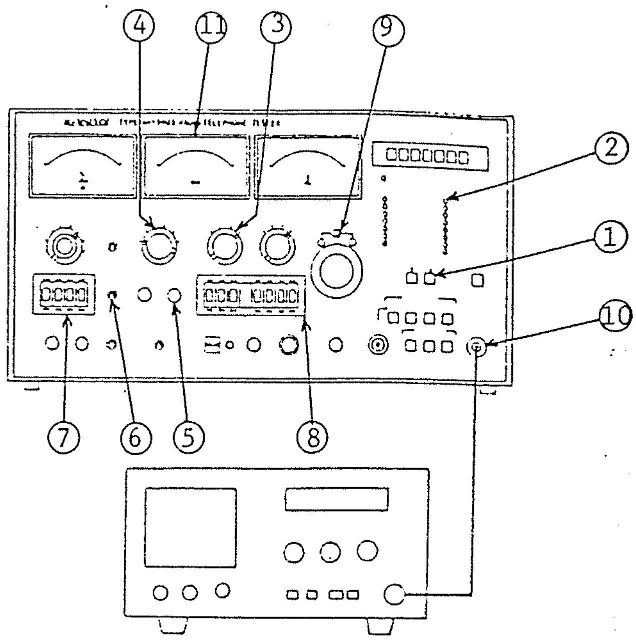
Fig. 4-9 Location of adjuster for calibration of the deviation meter of signal generator

80

(2) Calibration using frequency spectrum analyzer

For the theory of calibration, refer to 4.3.3 "Calibration of the Deviation Meter of FM Linear Detector" in which the theory of and procedure for deviation meter calibration for FM signal generator are discussed.

Calibration setup



Spectrum analyzer

Fig. 4-10 Setup for calibration of the deviation meter of signal generator (by use of spectrum analyzer)

Calibration procedure

(1) As test item, set [AF INPUT LEVEL] (2) by pressing the [▼] or [▲] button (1).

(2) Set the [DEVIATION kHz] range switch (3) to [5].

(3) Set the [MOD SELECT] switch (4) to [INT].

81

(4) Turn the [1 kHz OR EXT] knob (5) fully counterclockwise and leave it there.

(5) Set the [FREQUENCY RANGE] switch (6) to [x1] and the [AF OSCILLATOR 50 ∿ 2999 Hz] (7) to [906].

(6) Set the [RF FREQUENCY 25 ∿ 520 MHz] (8) to [250.0000] and the [OUTPUT LEVEL dBμ] dial (9) to [80].

(7) Connect a spectrum analyzer to the [RF INPUT/OUTPUT 50 Ω MAX. 25 W] (10) and bring the 250 MHz signal to the center of the screen as illustrated in Fig. 4-11.

At this time, set the sweep width of the spectrum analyzer to 1 ∿ 2 kHz/DIV. and IF width of the spectrum analyzer to 100 Hz or less.

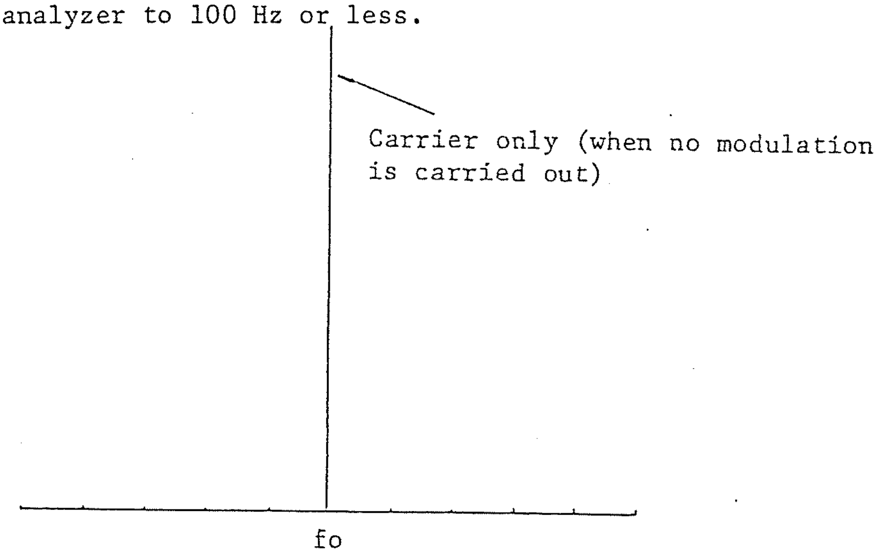


Fig. 4-11

(8) Gradually turn the [1 kHz OR EXT] knob (5) clockwise. The carrier (250.0000 MHz) will once disappear from the screen and it will then come up again. Keeping on turning the knob will cause the carrier to disappear again. Stop turning the knob when the carrier has disappeared for the second time.

(9) In that state in which the carrier has disappeard for the second time, bring the indication of the deviation meter (11) to [5 kHz] by adjusting RV1 on circuit board unit P5 (PRE-100230). (See Fig. 4-9.)

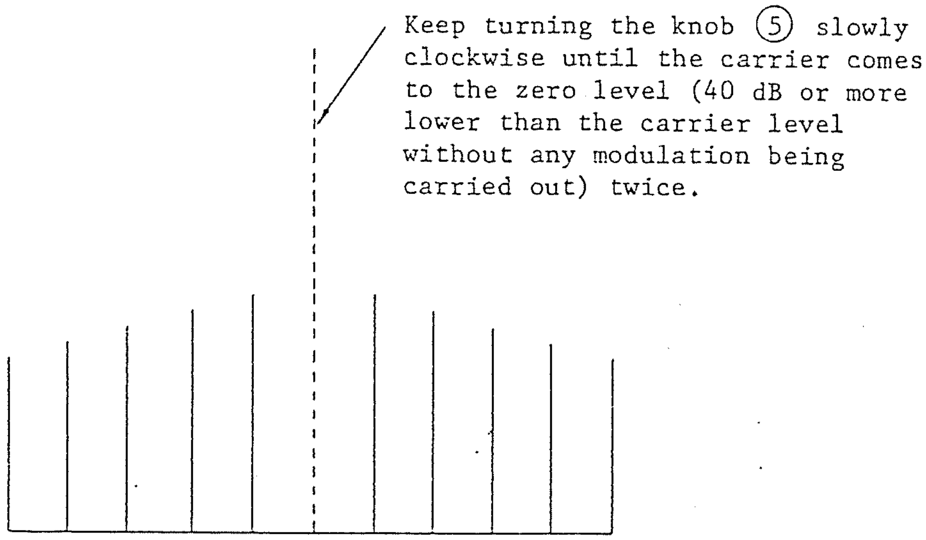


Fig. 4-12

> NOTE
>
> To attain a calibration accuracy of $\pm 1\%$ or less, not only the modulation frequency accuracy must be kept at $\pm 1\%$ or less, but the residual level after carrier disappearance must be 40 dB or more lower than the carrier level without any modulation being performed.

(3) Theory of calibration for deviation accuracy

The FM wave can be expressed by an equation of the relationship in which the carrier and side band amplitude varies as the class-1 Bessel function of the n-th degree that is determined

83

depending on the modulation index.

The modulation index, modulation frequency and frequency deviation are related as follows:

$$\text{Modulation index} = \frac{\text{Frequency deviation}}{\text{Modulation frequency}}$$

$$\text{Frequency deviation} = \text{Modulation index} \times \text{Modulation frequency}$$

When the modulation index and the modulation frequency are known, accurate calibration for deviation indication can be carried out.

The modulation index can be determined, after the modulation frequency is accurately counted with a frequency counter, by using a spectrum analyzer as described in the following.

The amplitude variation of the FM carrier and the modulation index are related as shown in Fig. 4-13. As shown, the carrier amplitude becomes zero when the modulation index is 2.4048, 5.5201, 8.6537, 11.7951, ... Therefore, when the carrier amplitude being shown on a spectrum analyzer becomes zero, the modulation index is one of 2.4048, 5.5201, ...

For calibration, first count the modulation frequency of the FM signal generator. Next, observing the RF output with the spectrum analyzer, bring the carrier amplitude to zero by adjusting the frequency deviation. When the carrier amplitude becomes zero for the first time by having the frequency deviation gradually varied from the unmodulated state, the modulation index is 2.4048. When it becomes zero for the second time, the modulation index is 5.5201. Then, calibrate the deviation meter by utiliz-

ing the equation expressing the relationships among the modulation index, frequency deviation and modulation frequency. Typical Typical calibration data are listed in Table 4-1.

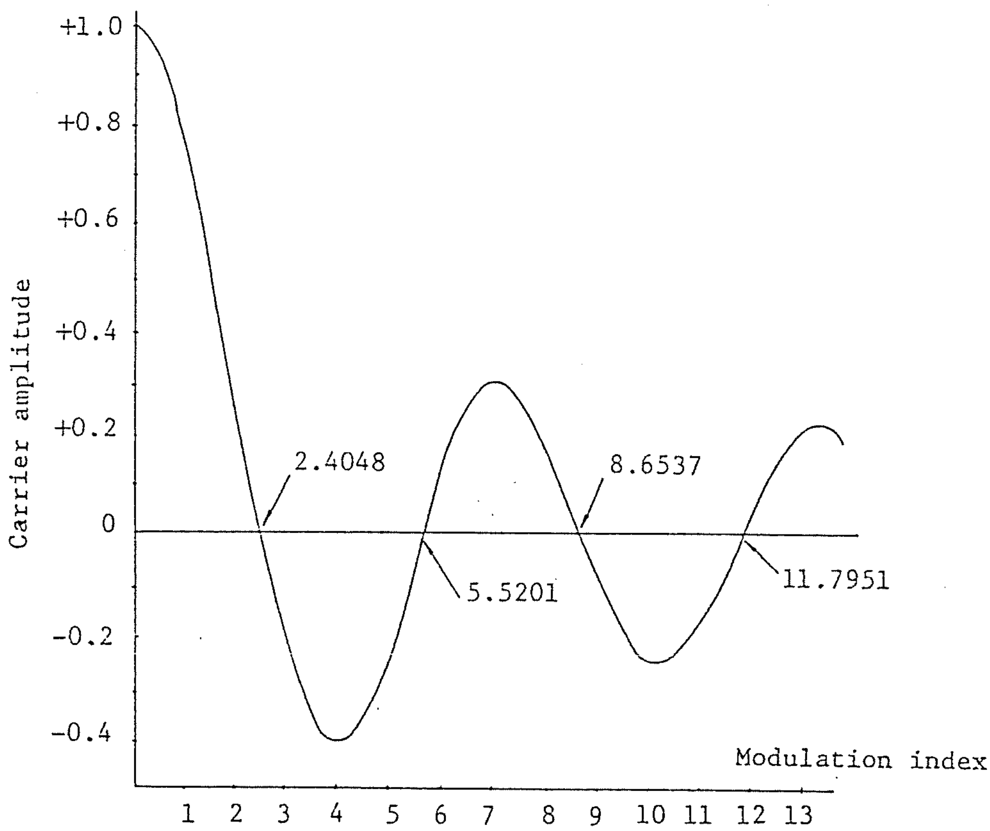


Fig. 4-13 Relationship between frequency modulation index and carrier amplitude

Table 4-1

Frequency deviation kHz	Modulation frequency kHz	Number of times of carrier amplitude becoming zero
3.5	1.455	1
5	0.906	2
10	1.156	3

85

4.3.3 Calibration of RF Wattmeter

Calibration setup

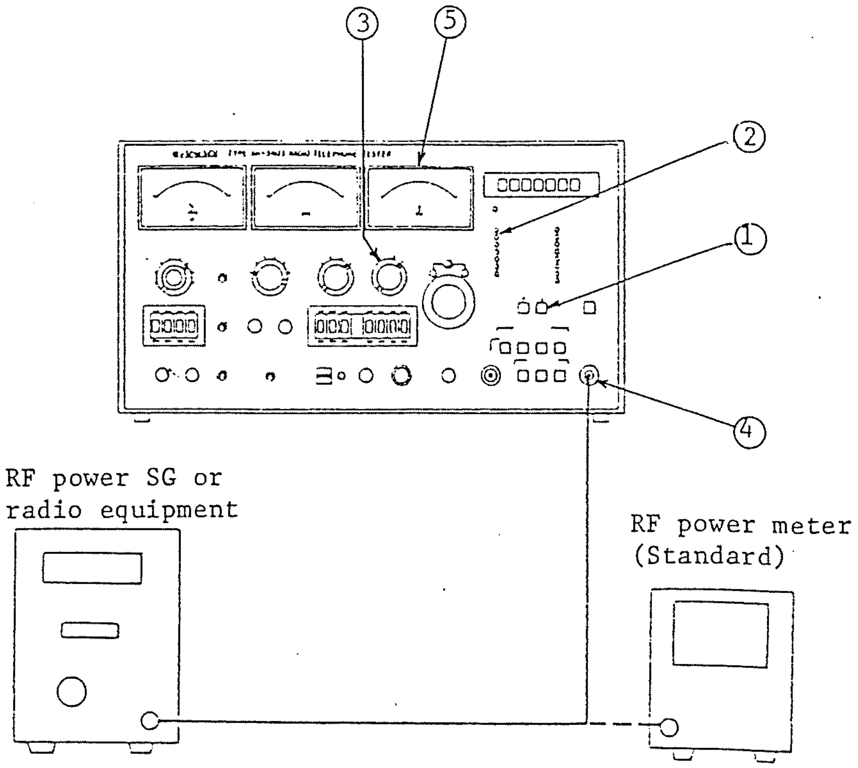


Fig. 4-14 Setup for RF wattmeter calibration

Calibration procedure

(1) As test item, set [AF LEVEL SET] ② by pressing the [↑] or [↓] button ①.

(2) Set the [RF POWER W] ③ to range [1.5].

(3) Bring the indication of the RF wattmeter ⑤ to zero, without any signal connected to the [RF INPUT/OUTPUT 50 Ω MAX. 25 W] ④, by adjusting RV4 on circuit board unit P12 (PRE-901945).

(4) Adjust the RF output power of the RF signal generator or radio equipment to be 1.5 W by using the standard RF wattmeter for measurement.

86

(5) Disconnect the RF output connection cord of the RF signal generator or radio equipment from the standard RF wattmeter and connect it to the [RF INPUT/OUTPUT 50 Ω MAX. 25 W] ④.

(6) Bring the indication of the RF wattmeter ⑤ to the full scale point by adjusting RV5 on circuit board unit P12 (PRE-901945).

(7) Adjust the RF output power of the RF signal generator or radio equipment to be 7.5 W.

(8) Set the [RF POWER W] ③ to range [7.5].

(9) Connect the RF output connection cord of the RF signal generator or radio equipment to the [RF INPUT/OUTPUT 50 Ω MAX. 25 W] ④.

(10) Bring the indication of the RF wattmeter ⑤ to the full scale point by adjusting RV6 on circuit board unit P12 (PRE-901945).

(11) Repeat the calibration procedure for different range settings, [15] and [30], respectively, of the [RF POWER W] ③.

For adjustment in the above ranges, use RV7 and RV8 on circuit board unit PRE-901945, respectively.

Remarks:	Circuit board unit P12 (PRE-901945) is located at the bottom center of the apparatus. Its component layout is shown in Fig. 4-15.

57

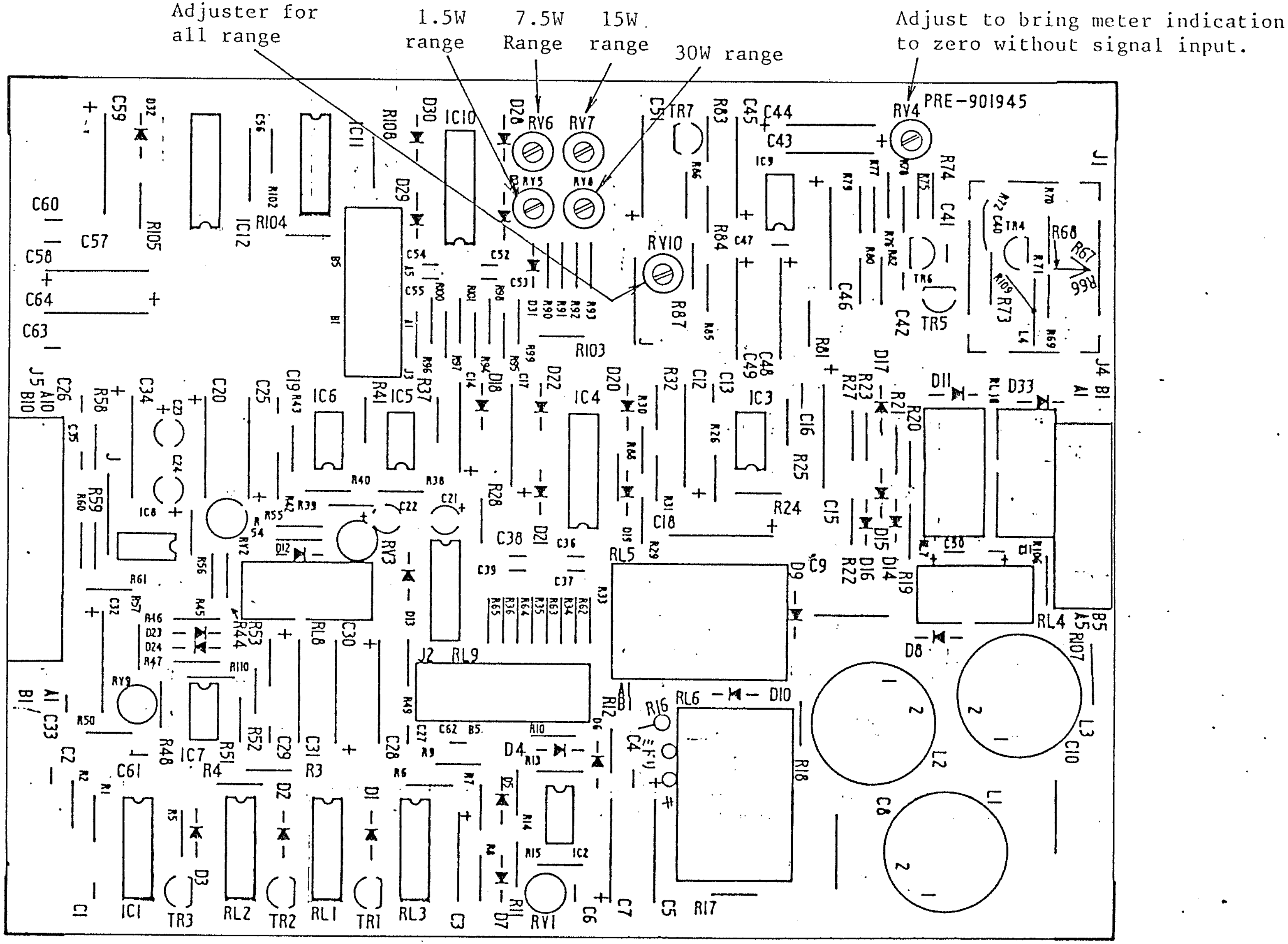


Fig. 4-15 Component layout on P12 (PRE-901945)

4.3.4 Calibration of the Deviation Meter of FM Linear Detector

Calibration Setup

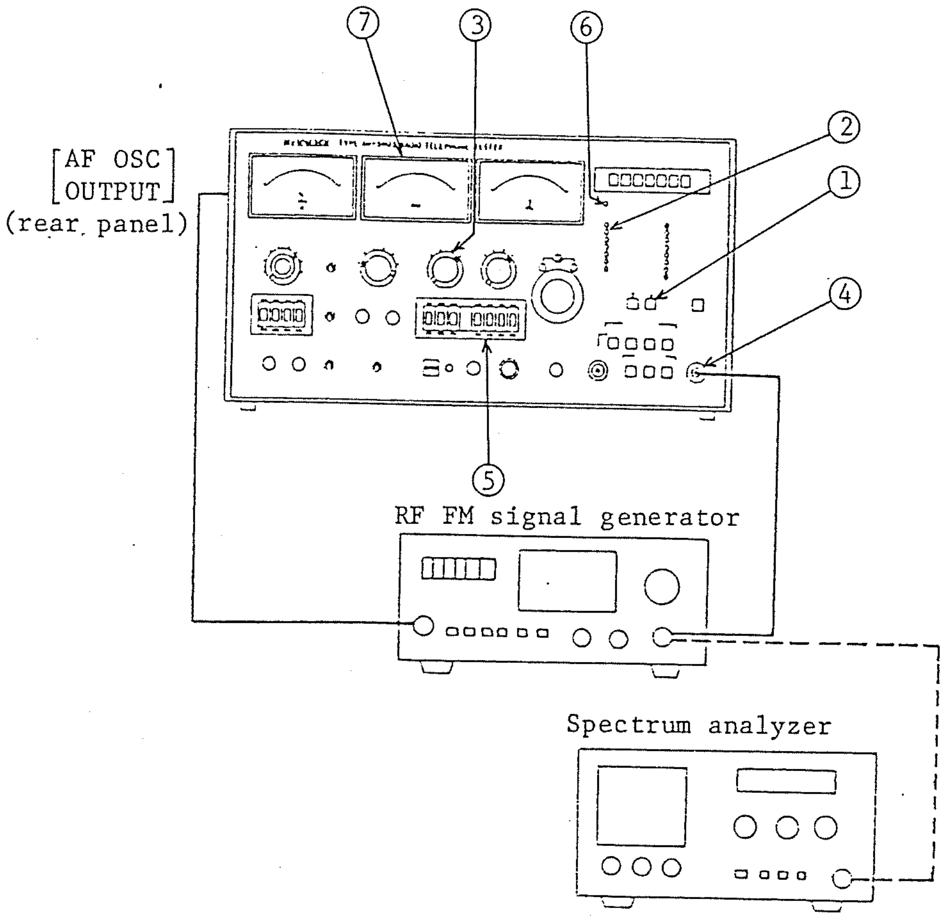


Fig. 4-16 Setup for calibration of the deviation meter

Calibration procedure

(1) As test item, set [AF LEVEL SET] (2) by pressing the [▼] or [▲] button (1).

(2) Set the [DEVIATION kHz] range switch (3) to [5].

(3) Connect an FM signal with its deviation verified to the [RF INPUT/OUTPUT 50 Ω MAX. 25 W] (4). (Methods of FM signal generator calibration for deviation accuracy were already described in the foregoing.)

59

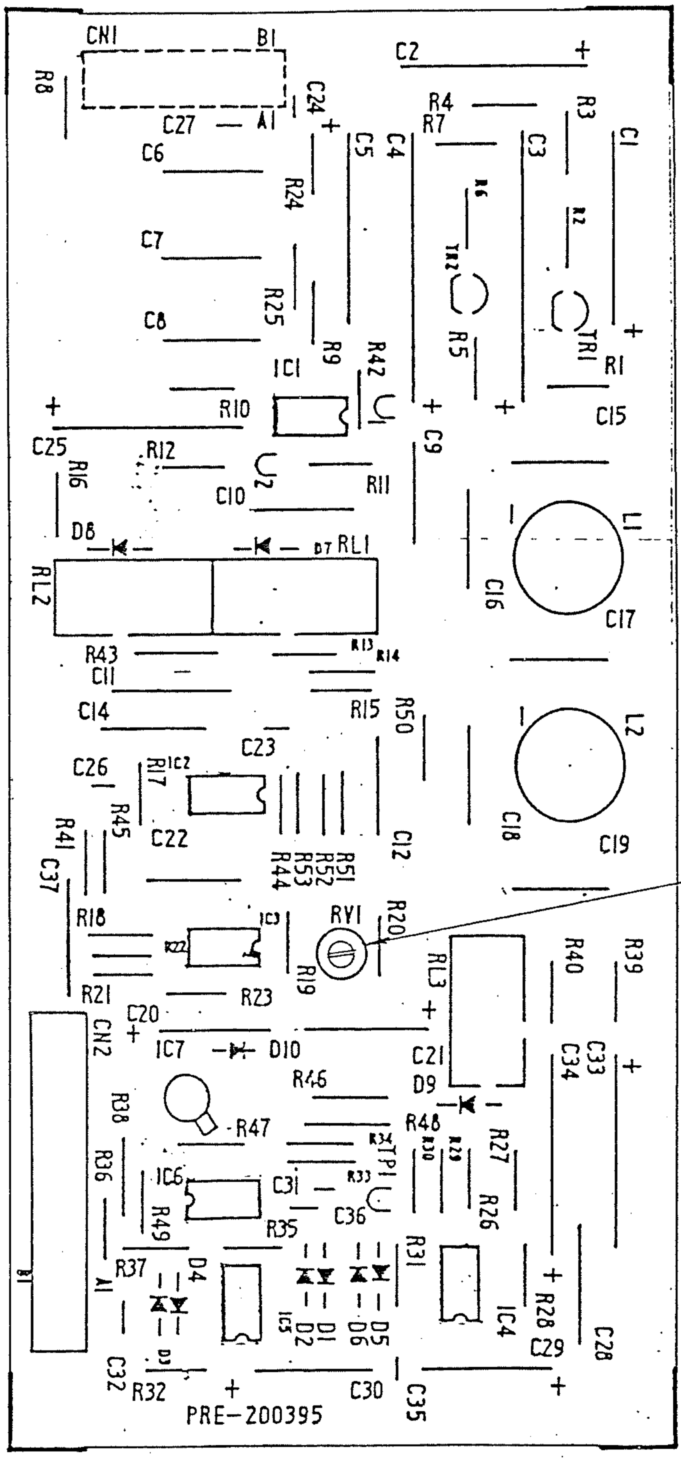
(4) Set the [RF FREQUENCY 25 ∿ 520 MHz] (5) to the same frequency as that of the input signal by pressing the frequency setting switch $\boxed{+}$ or $\boxed{-}$.

(5) The red [FM DEMO OPERATION] lamp (6) lights to indicate that the FM linear detector is working.

(6) The pointer of the deviation meter (7) swings. Bring the meter indication to be the same as the verified output value of the FM signal generator by adjusting RV1 on circuit board unit P10 (PRE-200395).

The component layout on P10 (PRE-200395) is shown in Fig. 4-17.

90



Adjust for equalization with verified value.

Fig. 4-17 Component layout on P10 (PRE-200395)

4.3.5 Calibration of AF Level Meter

Calibration setup

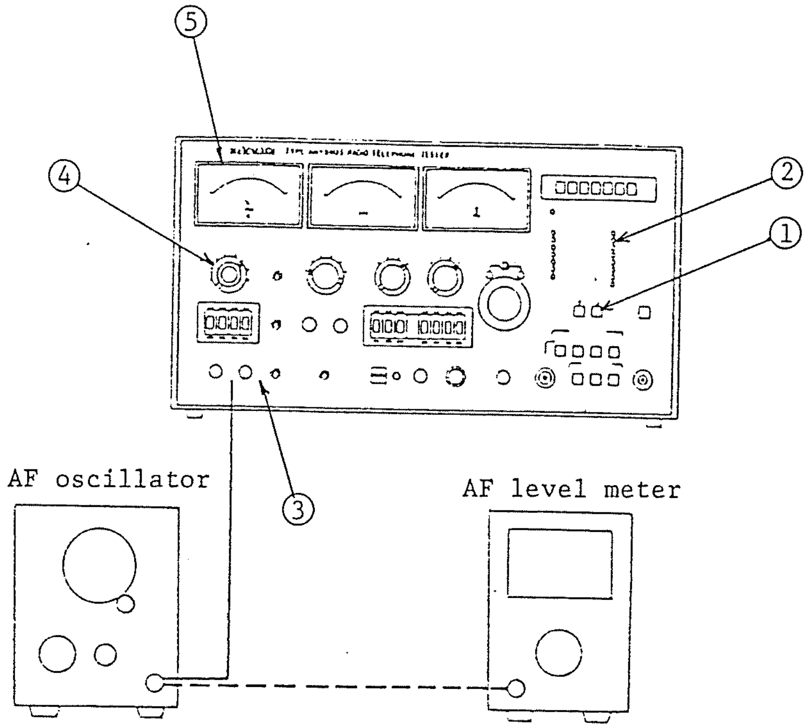


Fig. 4-18 Setup for calibration of AF level meter

Calibration procedure

(1) As test item, set [AF INPUT LEVEL] ② by pressing [▼] or [▲] button ①.

(2) Without anything connected to the [INPUT] terminal of the [AF LEVEL METER] ③, make sure that the AF level meter reads [0] on the percentage-scale. If the reading is not [0], make it [0] by adjusting RV9 on circuit board unit P12 (PRE-901945).

(3) Set the impedance switch [AF LEVEL METER] ③ to [600 Ω] and connect a AF oscillator to the [INPUT] terminal.

92

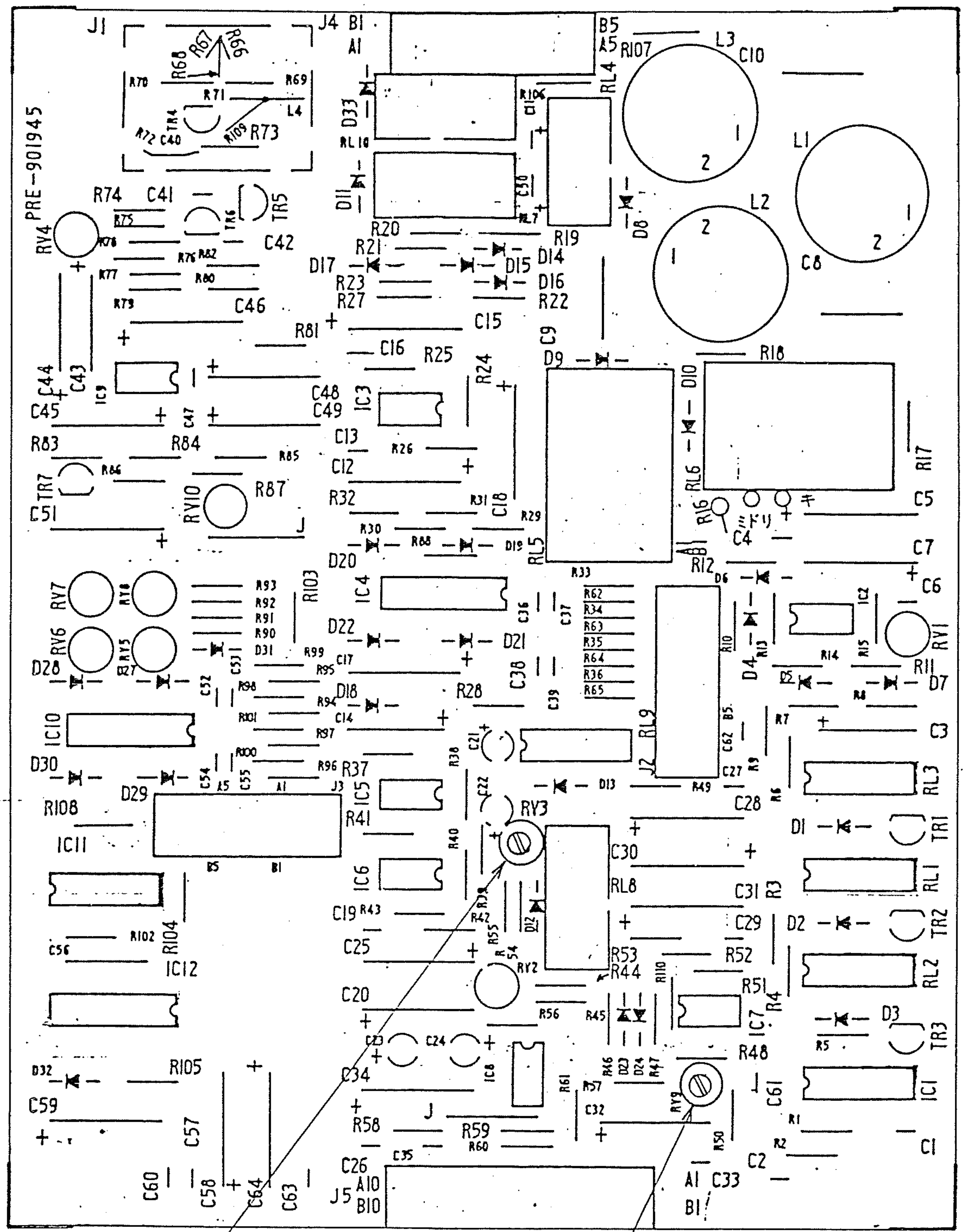
(4) Set the output frequency and output level of the AF oscillator to 1,000 Hz and 0 dBm (0.775 V rms) respectively.

(5) Set the AF level meter range switch (4) to [0 dBm].

(6) Bring the indication of the AF level meter (5) to the 0 dBm (full scale) point by adjusting RV2 on circuit board unit P12 (PRE-901945).

The component layout on P12 (PRE-901945) is shown in Fig. 4-19.

93



Adjust to bring the meter indication to the full scale for an input of 0 dBm.

Adjust to bring the meter indication to zero with no signal input.

Fig. 4-19 Component layout on P12 (PRE-901945)

4.4 DISCONNECTING INTERNAL CONNECTIONS AND REMOVING HIGH FREQUENCY UNITS

Of the internal connections of this apparatus, the coaxial cord connections are shown in Fig. 4-20 and Fig. 4-21.

The high frequency circuits are cased in castings for wave leakage prevention. Their test and adjustment must, in principle, be conducted at the factory. Particularly, refrain from attempting to adjust high frequency coils, since improper adjustment can cause their characteristic to deteriorate.

Should it become necessary to inspect a high frequency unit, handle it with adequate care.

To remove a high frequency unit, proceed as follows referring to Fig. 4-22.

(1) Disconnect the coaxial cords connected to the high frequency unit to be removed and its vicinity.

(2) Remove the two screws that hold the high frequency unit.

(3) The bottom part of each high frequency unit is made in a mother board structure having printed circuit board connectors for convenience for power supplies, etc. When removing a high frequency unit, lift it straight up.

To reinstall the unit, fit the guide holes of the unit to the guide pins projecting from the chassis and push the unit straight down taking care so that the printed circuit board connectors attached to the unit are inserted smoothly. Then, fasten the unit with two screws and re-connect the coaxial cords.

95

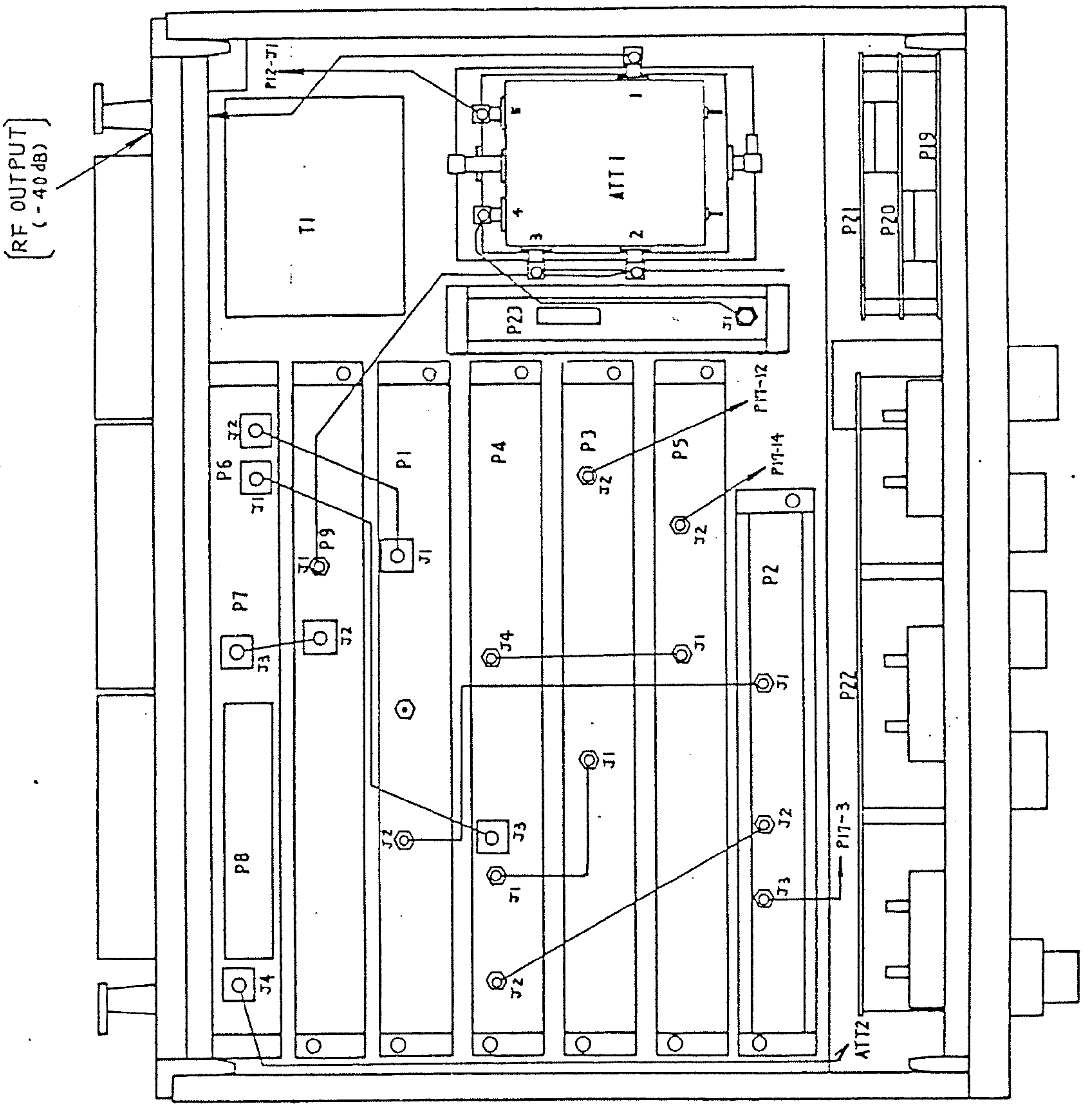


Fig. 4-20 Internal connections (top view)
(Coaxial cords)

96

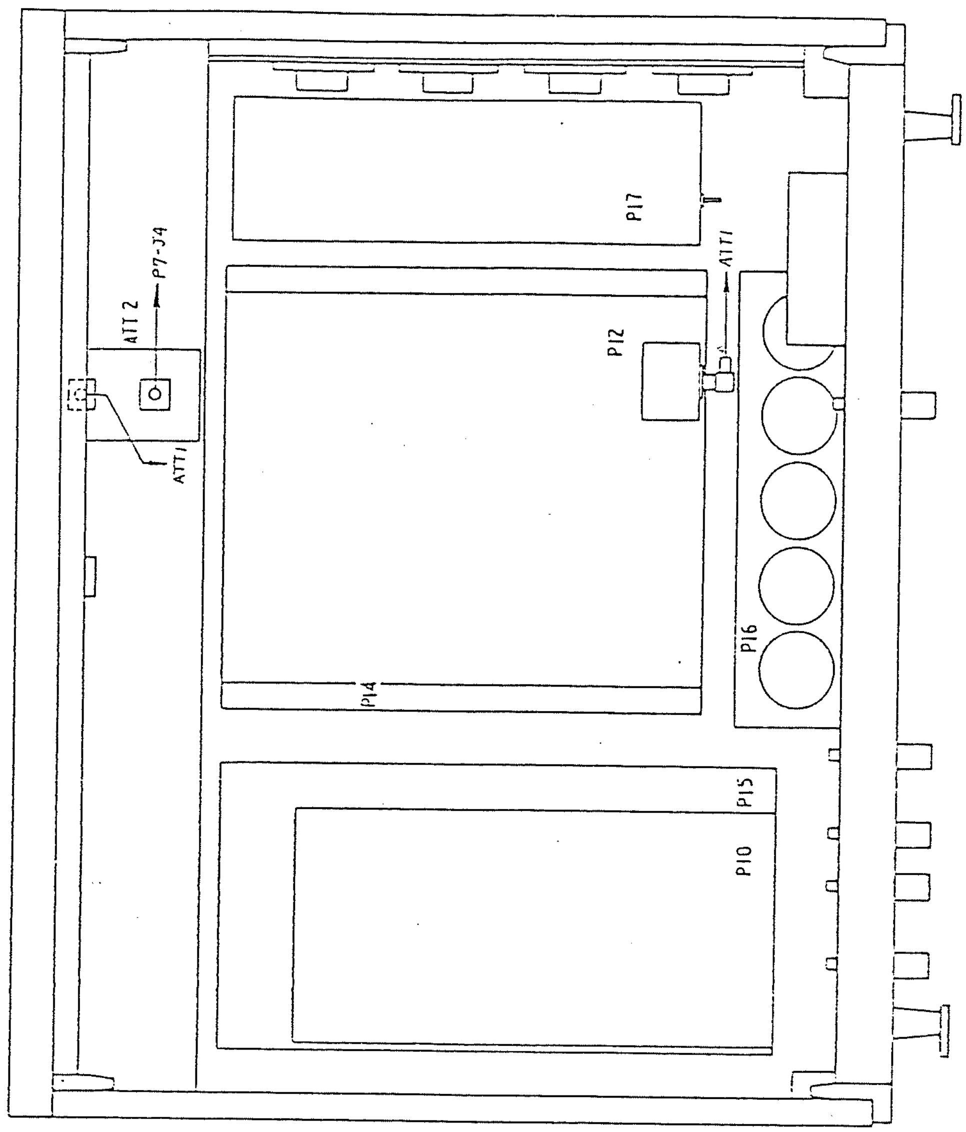


Fig. 4-21 Internal connections (bottom view)
(Coaxial cords)

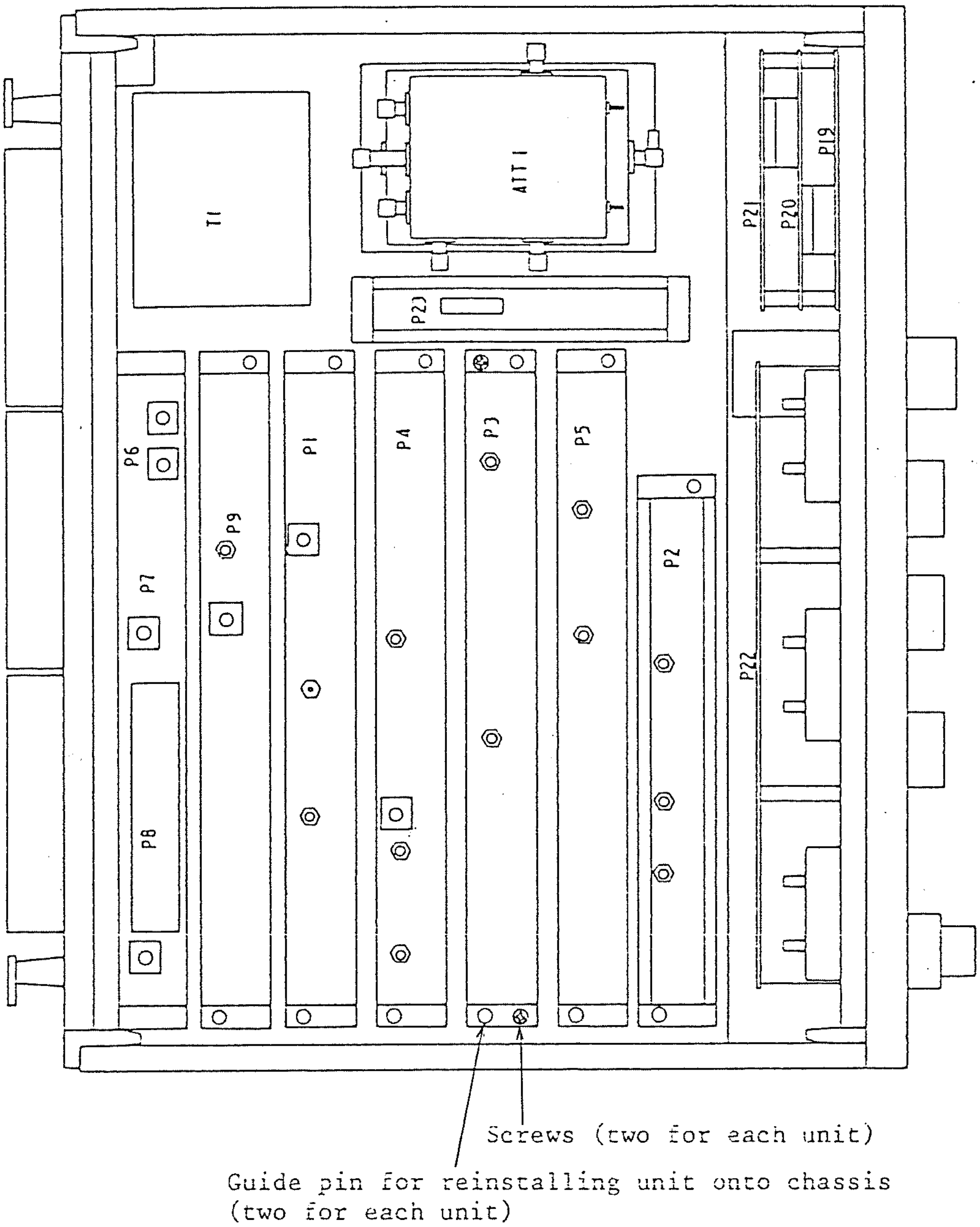


Fig. 4-22 Removing high frequency units (casting case)

(1) Disconnect the coaxial cords connected to the unit to be removed and its vicinity.

(2) Remove the two screws that hold the specific unit to the chassis.

(3) Lift the unit straight up taking care not to damage the printed circuit board connectors attached to the bottom of of the unit.

98

SECTION 5

CIRCUITS

The block diagram of this apparatus is shown in Fig. 5-1.

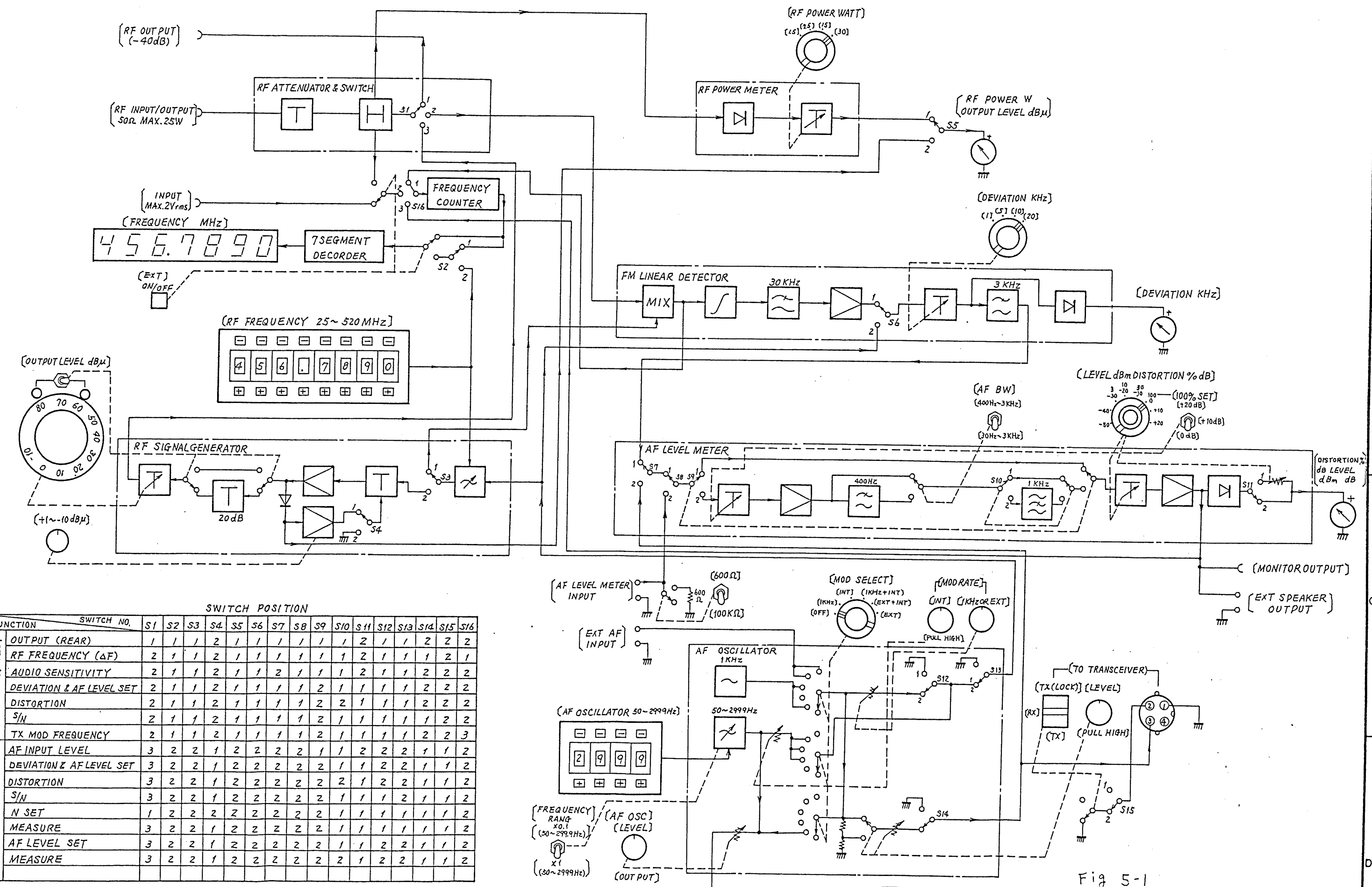
Figures 5-2-1/18 through 5-2-18/18 are schematic diagrams.

The functions of the test item selection switches and relay circuits are shown in Table 5-1.

NOTE :

In calibration, do not adjust other than the adjusters (semi-fixed resistances, condensers, etc.) mentioned in SECTION 4, as otherwise, deterioration of characteristics of the apparatus can be caused. Should calibration not covered by SECTION 4 become necessary, contact your local dealer.

99



SWITCH POSITION

FUNCTION	SWITCH NO.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
TRANS MITTER TEST	OUTPUT (REAR)	1	1	1	2	1	1	1	1	1	1	2	1	1	2	2	2
	RF FREQUENCY (ΔF)	2	1	1	2	1	1	1	1	1	1	2	1	1	1	2	1
	AUDIO SENSITIVITY	2	1	1	2	1	1	2	1	1	1	2	1	1	2	2	2
	DEVIATION & AF LEVEL SET	2	1	1	2	1	1	1	1	2	1	1	1	1	2	2	2
	DISTORTION	2	1	1	2	1	1	1	1	2	2	1	1	1	2	2	2
	S/N	2	1	1	2	1	1	1	1	2	1	1	1	1	1	2	2
	TX MOD FREQUENCY	2	1	1	2	1	1	1	1	2	1	1	1	1	2	2	3
RECEIVER TEST	AF INPUT LEVEL	3	2	2	1	2	2	2	2	1	1	2	2	2	1	1	2
	DEVIATION & AF LEVEL SET	3	2	2	1	2	2	2	2	2	1	1	2	2	1	1	2
	DISTORTION	3	2	2	1	2	2	2	2	2	2	1	2	2	1	1	2
	S/N	3	2	2	1	2	2	2	2	2	1	1	1	2	1	1	2
	N SET	1	2	2	2	2	2	2	2	2	1	1	1	1	1	1	2
	MEASURE	3	2	2	1	2	2	2	2	2	1	1	1	1	1	1	2
	AF LEVEL SET	3	2	2	1	2	2	2	2	2	1	1	2	2	1	1	2
	MEASURE	3	2	2	1	2	2	2	2	2	2	1	2	2	1	1	2

Fig 5-1

ENG.	CHKD.	APP.	TYPE AH-5403 RADIO TELEPHONE TESTER
			BLOCK DIAGRAM
			ASD-7417 1/1

ISSUE	DATE	NOTES	CHKD.
1	57 9 29		
2			
3			
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ANDO ELECTRIC CO., LTD.

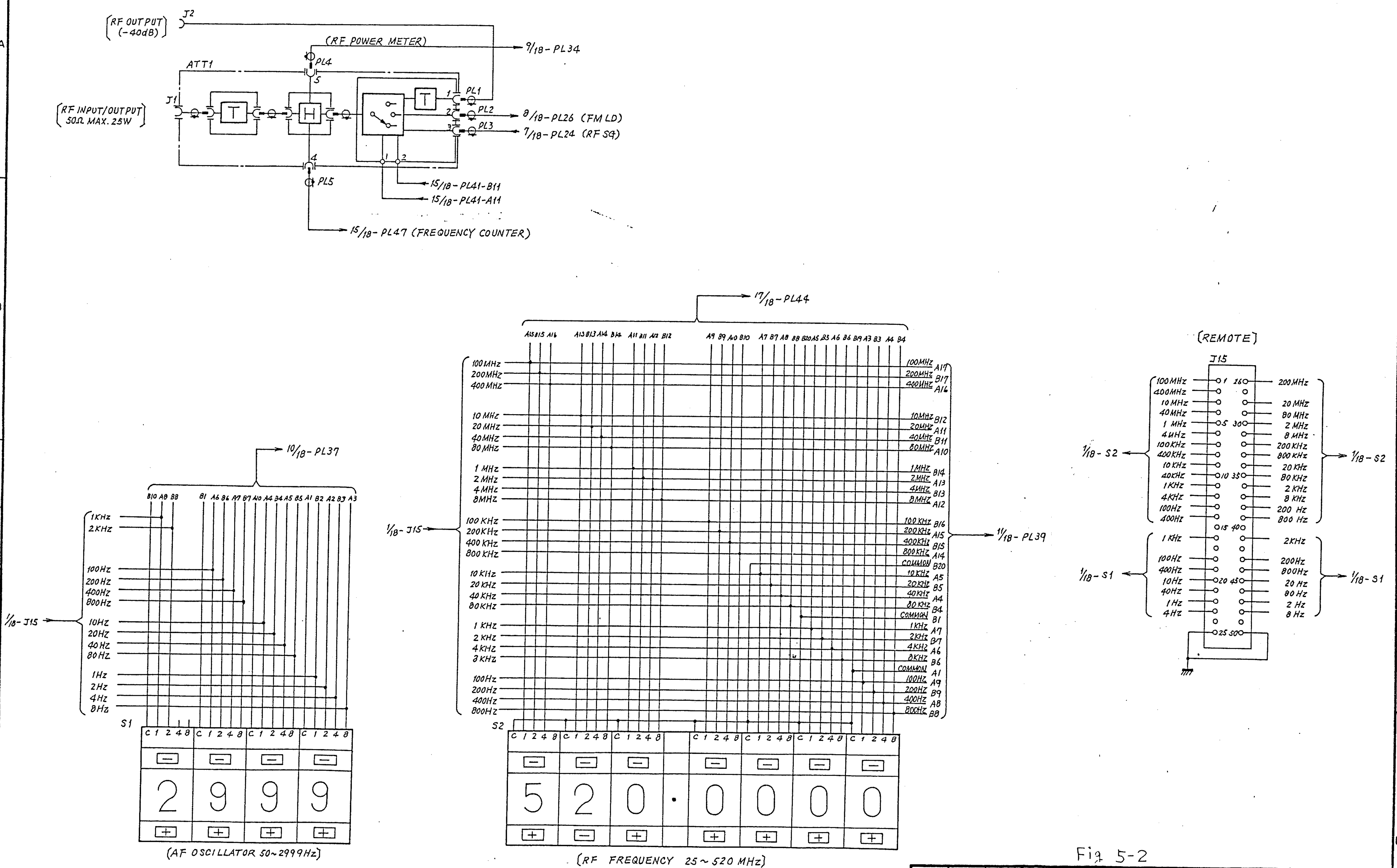
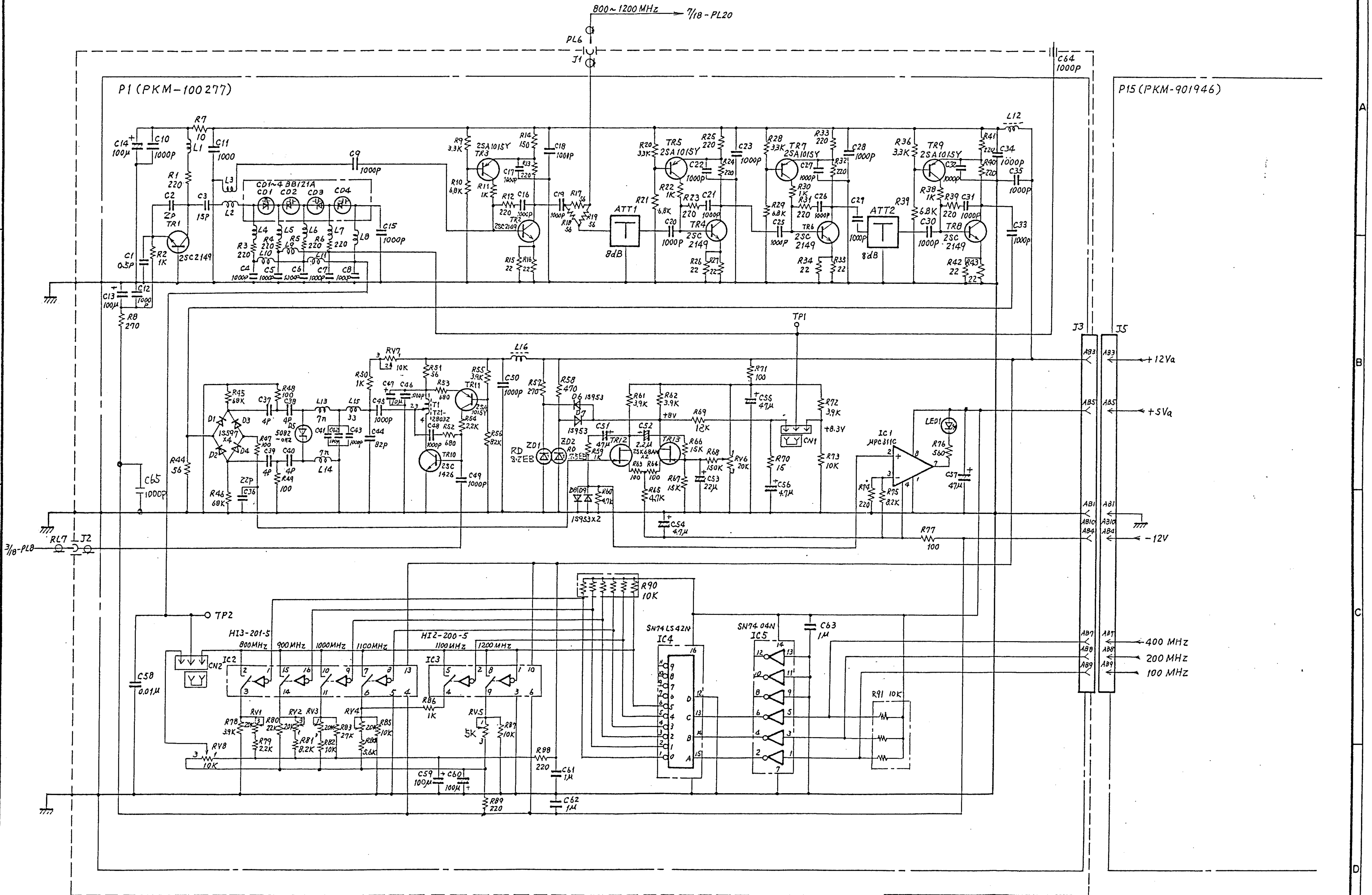


Fig 5-2

ENG.	CHKD.	APP.	
K. Aoki	3/Miyazaki	—	TYPE AH-5403 RADIO TELEPHONE TESTER SCHEMATIC DIAGRAM K-7417 1/18

ISSUE	DATE	NOTES	CHKD.
1			
2	57 7 27	再製	
3	53 11 11	ATT1 端子番号変更	青木



ENG.	CHKD.	APP.
—	—	—

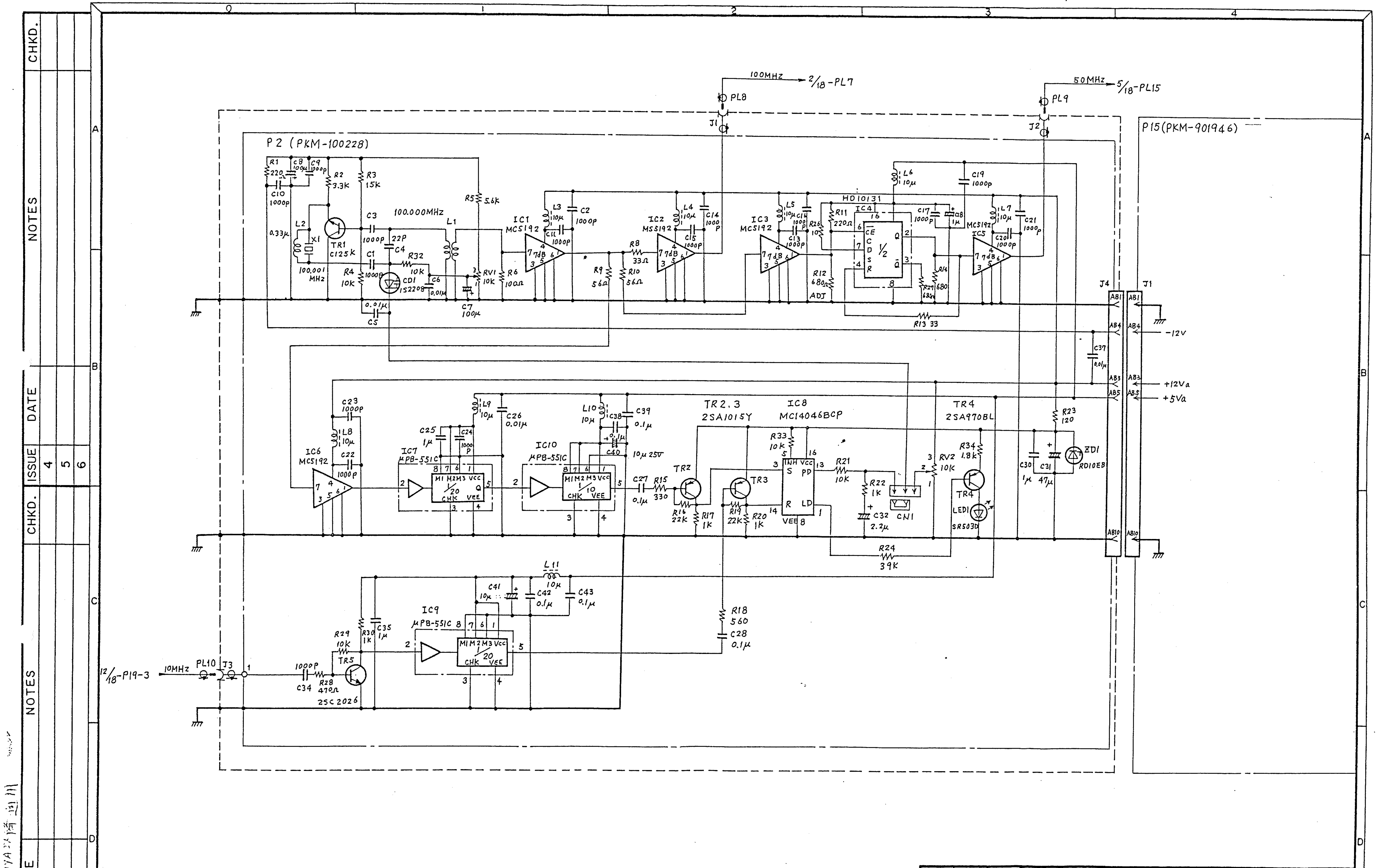
TYPE AH-5403 RADIO TELEPHONE TESTER

SCHEMATIC DIAGRAM

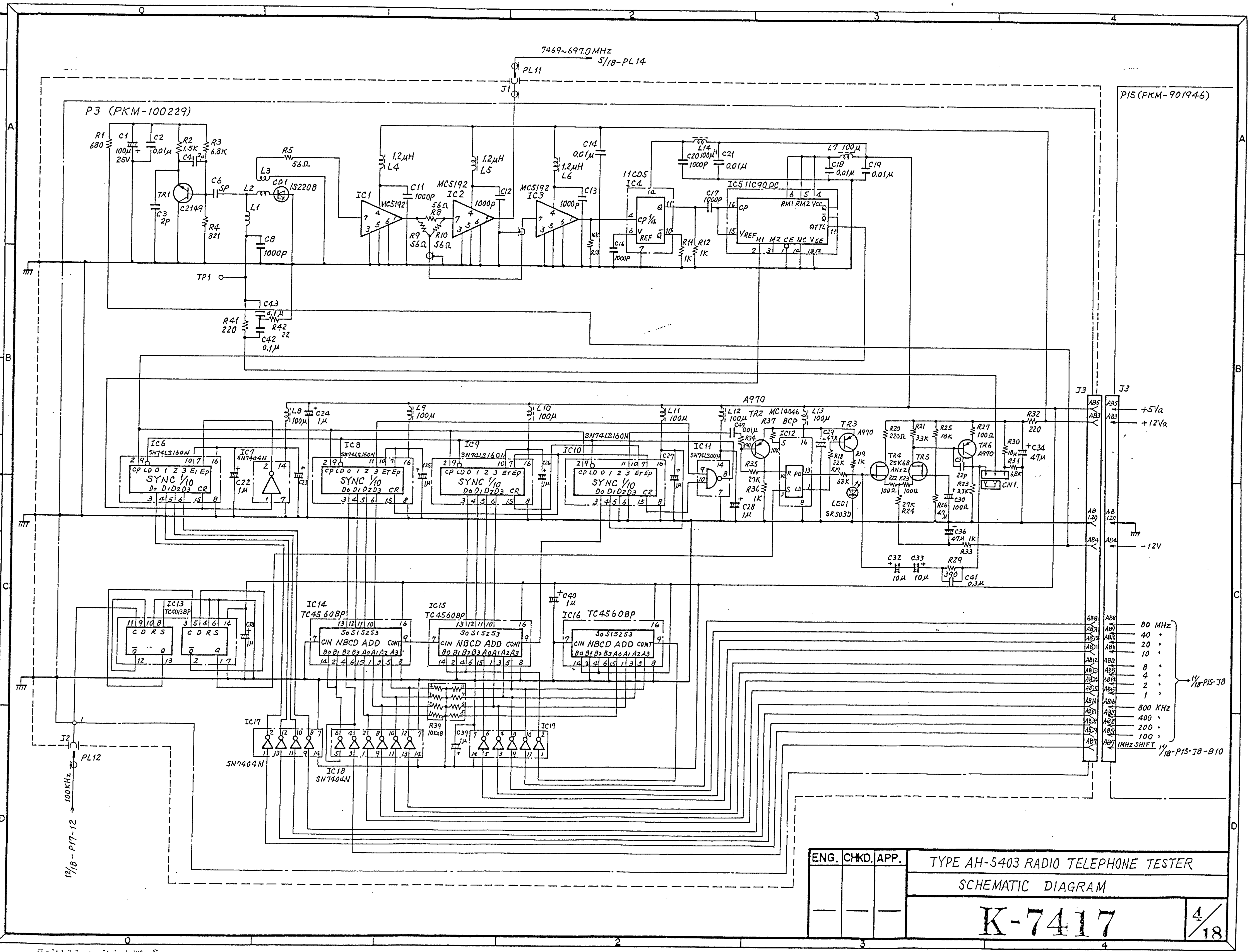
K-7417

2/18

ISSUE	DATE	NOTES	CHKD.
1			
2	58.4.26		
3	58.11.11	PRENO 変更	
4			
5			
6			



ENG.	CHKD.	APP.	TYPE AH-5403 RADIO TELEPHONE TESTER
—	—	—	SCHEMATIC DIAGRAM
			K-7417 3/18



ENG.	CHKD.	APP.	TYPE AH-5403 RADIO TELEPHONE TESTER
			SCHEMATIC DIAGRAM
—	—	—	K-7417 4/18

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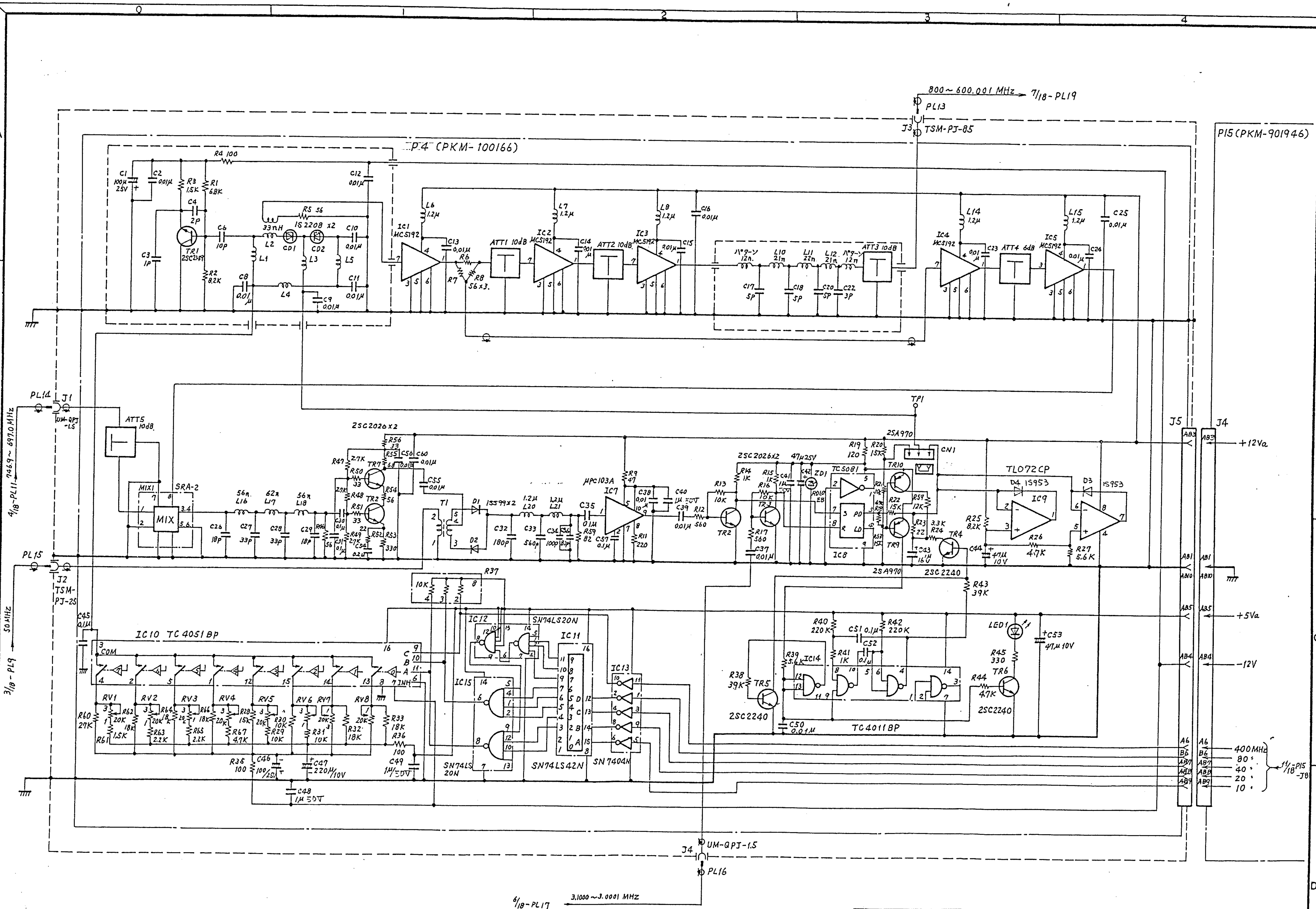


ENG.	CHKD.	APP.
—	—	—

TYPE AH-5403 RADIO TELEPHONE TESTER

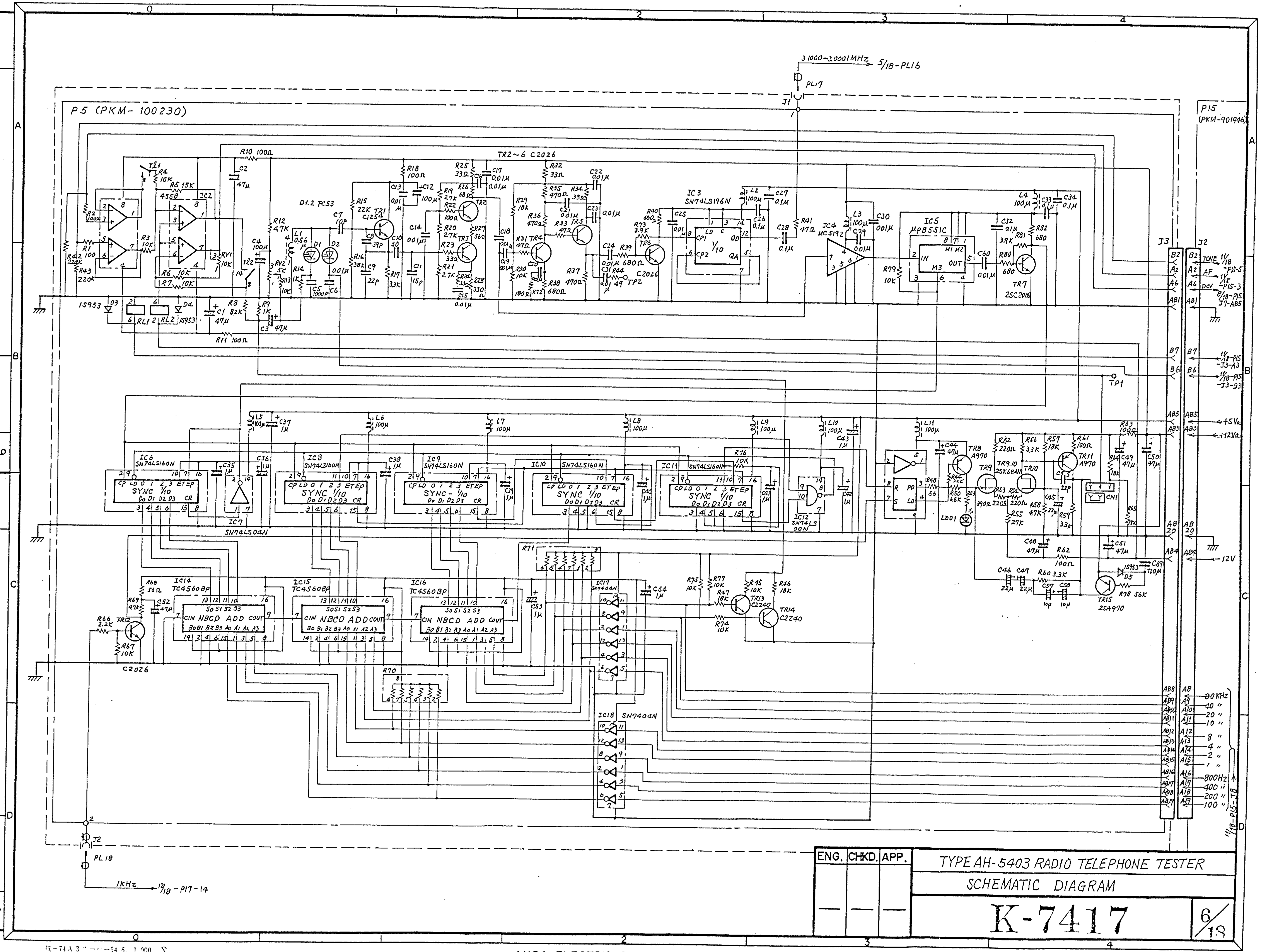
SCHEMATIC DIAGRAM

K-7417

5/18

ISSUE	DATE	NOTES	CHKD.
1	58 4 26	D3 D4 位置変更	青木
2	58 11 11	C43 変更	青木
3		C40.41.48.49.43. IC9 R26 定数変更 (T427-047)	
4			
5			
6			

ANDO ELECTRIC CO., LTD



ENG.	CHKD.	APP.
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TYPE AH-5403 RADIO TELEPHONE TESTER

SCHEMATIC DIAGRAM

K-7417

6/18

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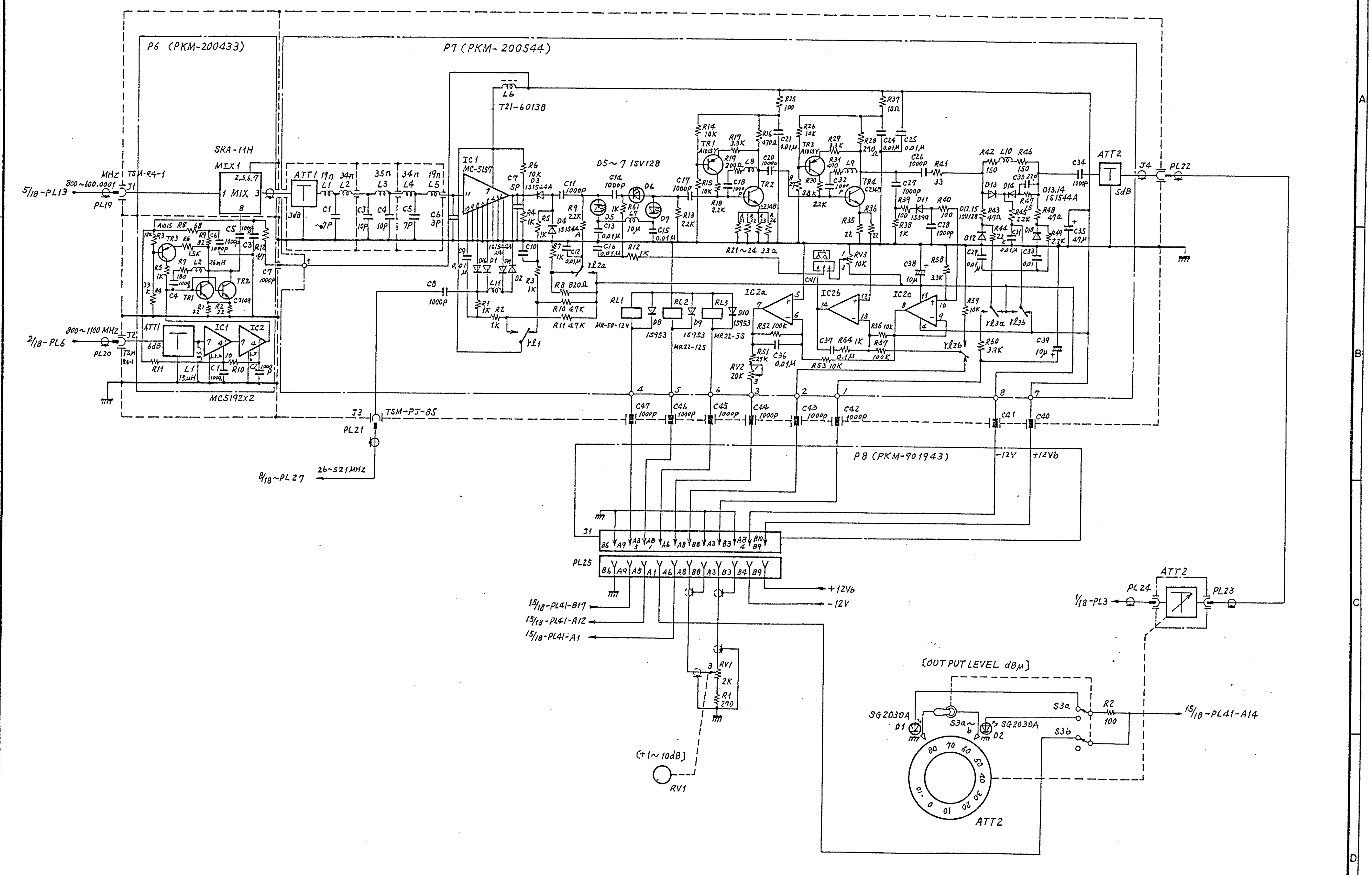
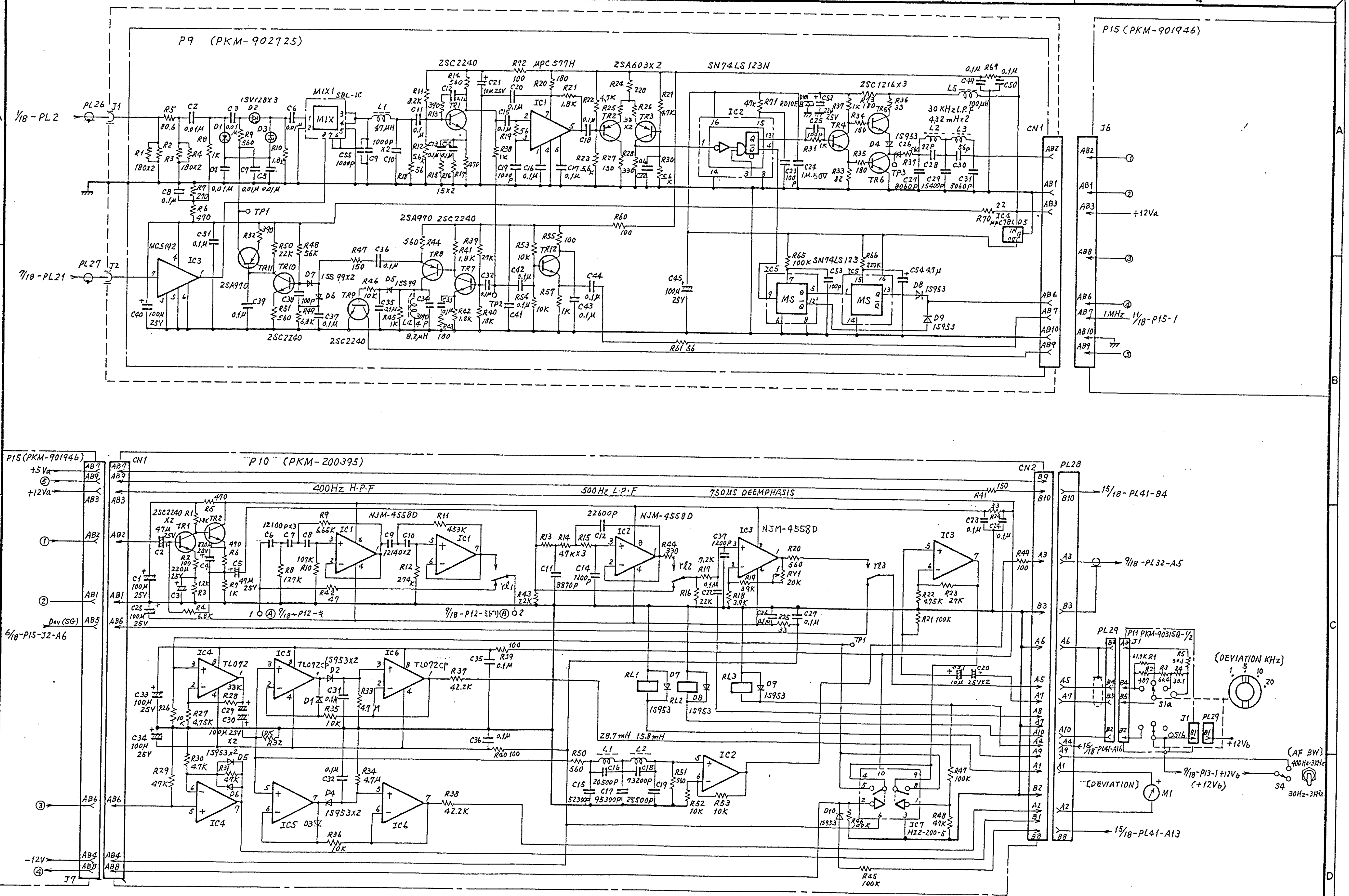


ENG.	CHKD.	APP.	TYPE AH-5403 RADIO TELEPHONE TESTER
—	—	—	SCHEMATIC DIAGRAM
			K-7417 — 7/18

CHKD. NOTES DATE ISSUE 4 5 6

CHKD. NOTES DATE ISSUE 1 2 3



ENG.	CHKD.	APP.	TYPE AH-5403 RADIO TELEPHONE TESTER
			SCHEMATIC DIAGRAM
—	—	—	K-7417 8/18

ISSUE	DATE		CHKD.	NOTES
1	58 4 26		青木	P9-C24, P10-IC6 変更, P10-IC3 部品追入 (T427-047)
2				
3				

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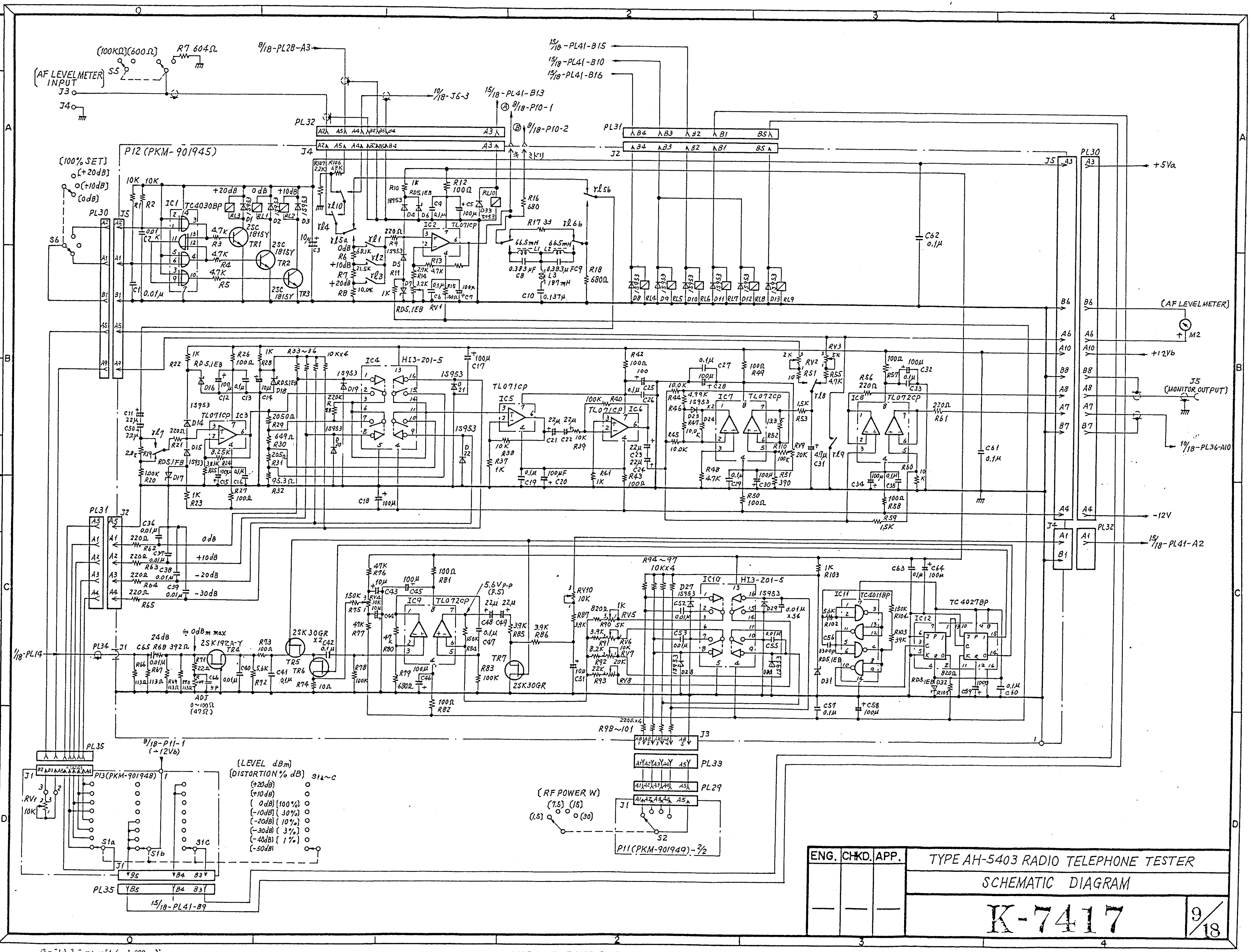
108



ENG.	CHKD.	APP.	TYPE AH-5403 RADIO TELEPHONE TESTER
—	—	—	SCHEMATIC DIAGRAM
			K-7417 9/18

ISSUE	DATE	NOTES	CHKD.
1	58 4 26	TR4 R71 R109 定数変更 C66 追記 L4 削除 (7427-047)	青木
2			
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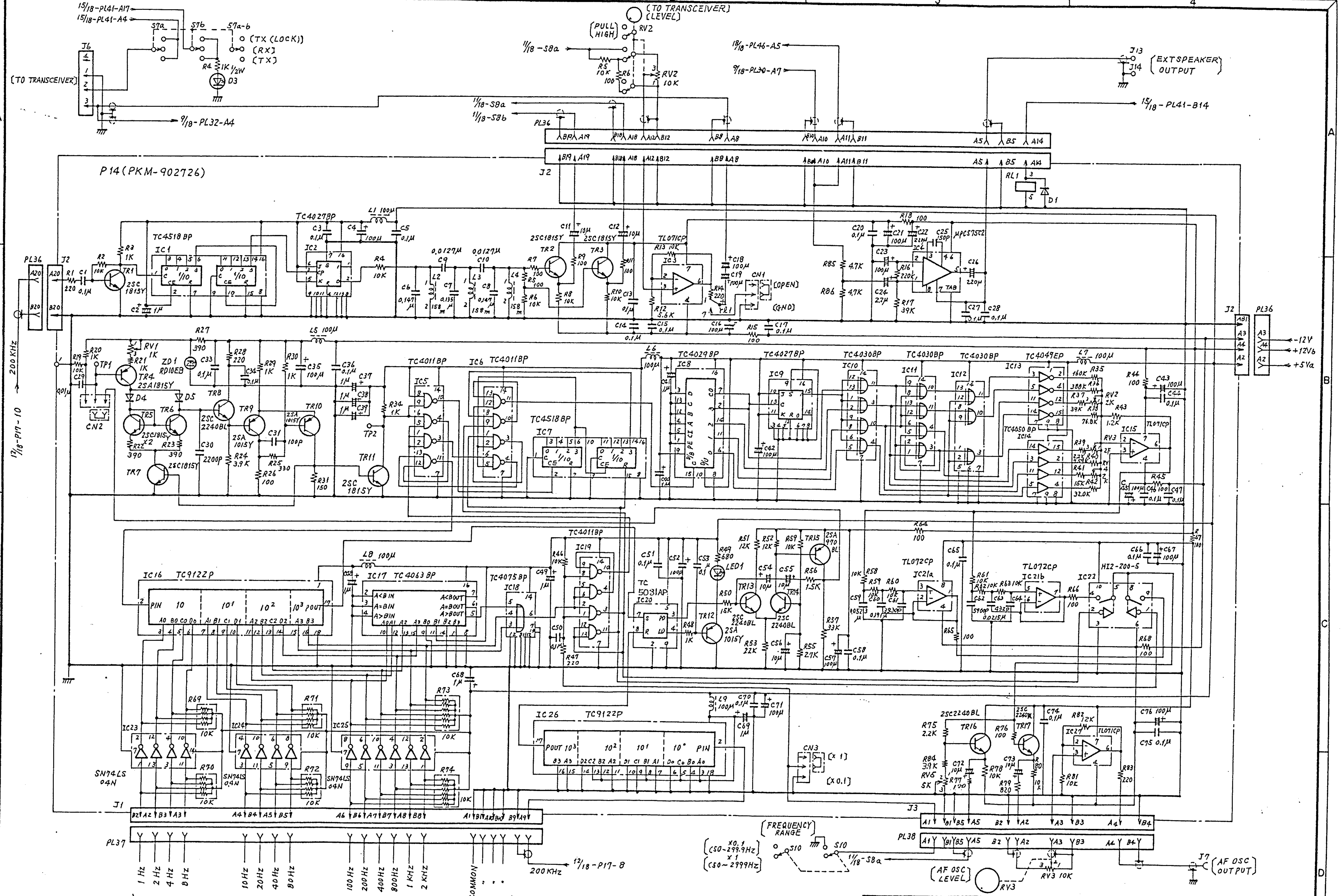
6			



ENG.	CHKD.	APP.
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TYPE AH-5403 RADIO TELEPHONE TESTER

SCHEMATIC DIAGRAM

K-7417

13/18

ISSUE	DATE	NOTES	CHKD.
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2	58. 4. 26	R45, 82 変更, IC20, R77 変更 (T427-047)	
3			
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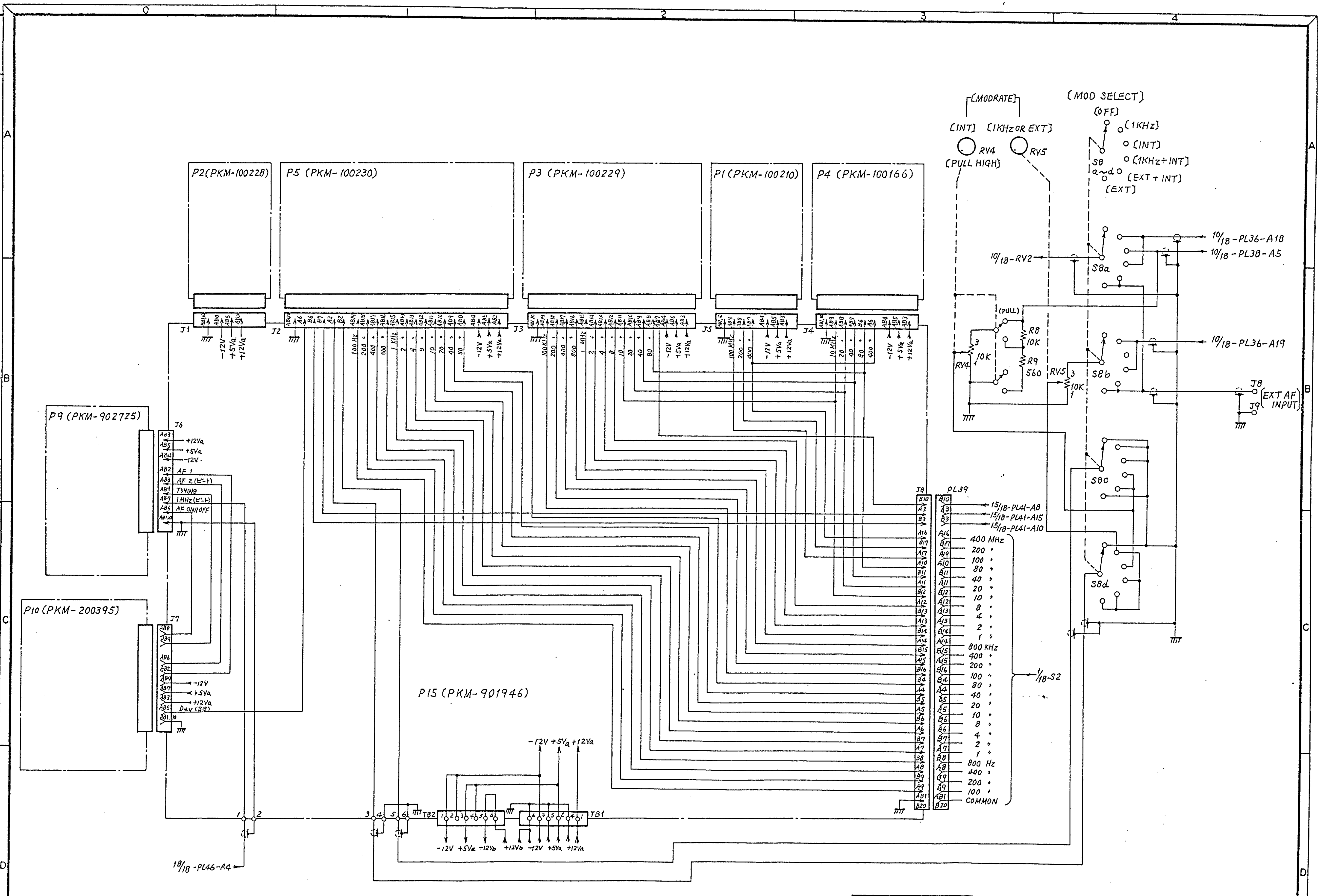

ENG.	CHKD.	APP.	TYPE AH-5403 RADIO TELEPHONE TESTER
—	—	—	SCHEMATIC DIAGRAM
			K-7417 — 11/18

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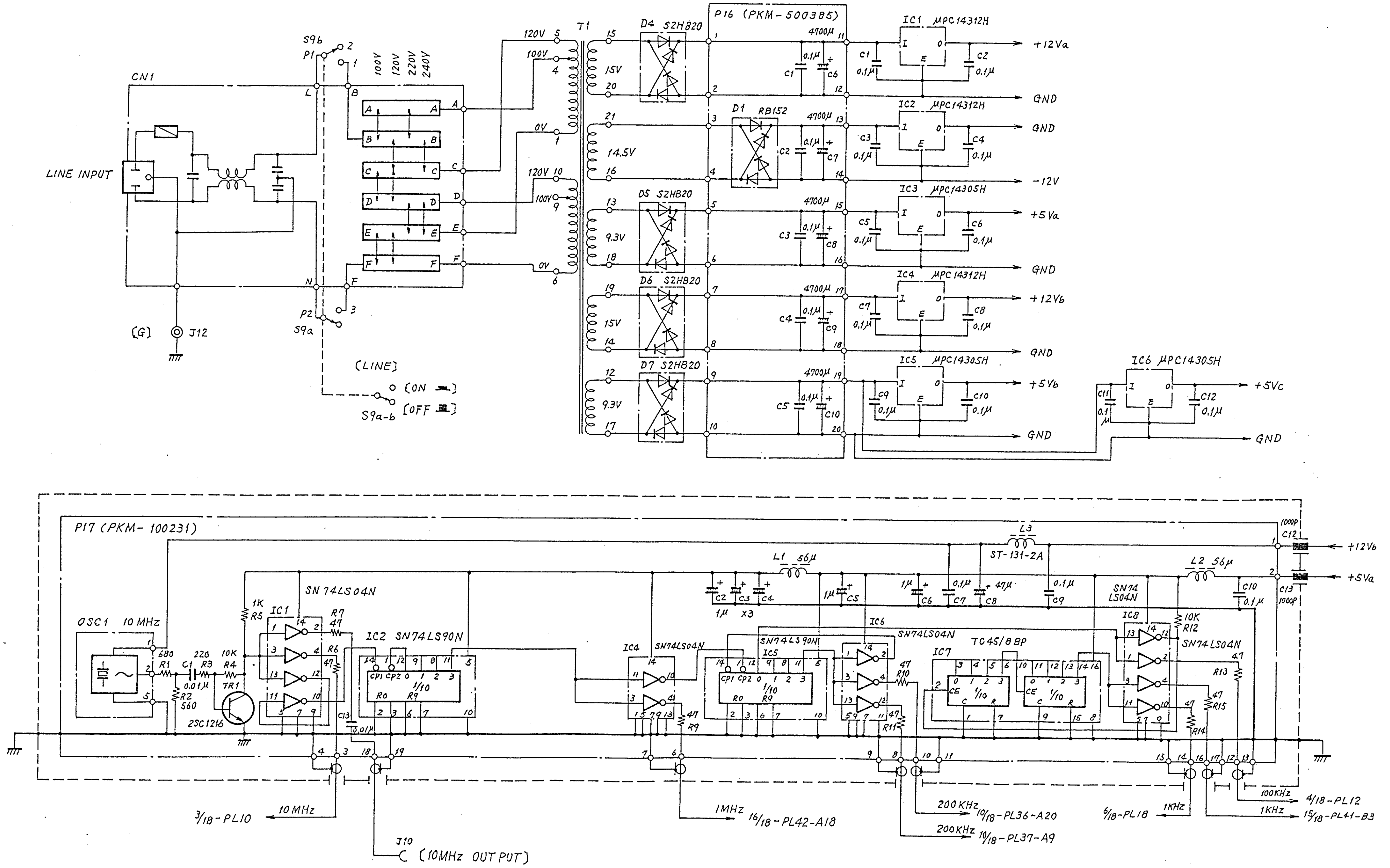

ENG.	CHKD.	APP.	
—	—	—	TYPE AH-5403 RADIO TELEPHONE TESTER SCHEMATIC DIAGRAM K-7417 12/18

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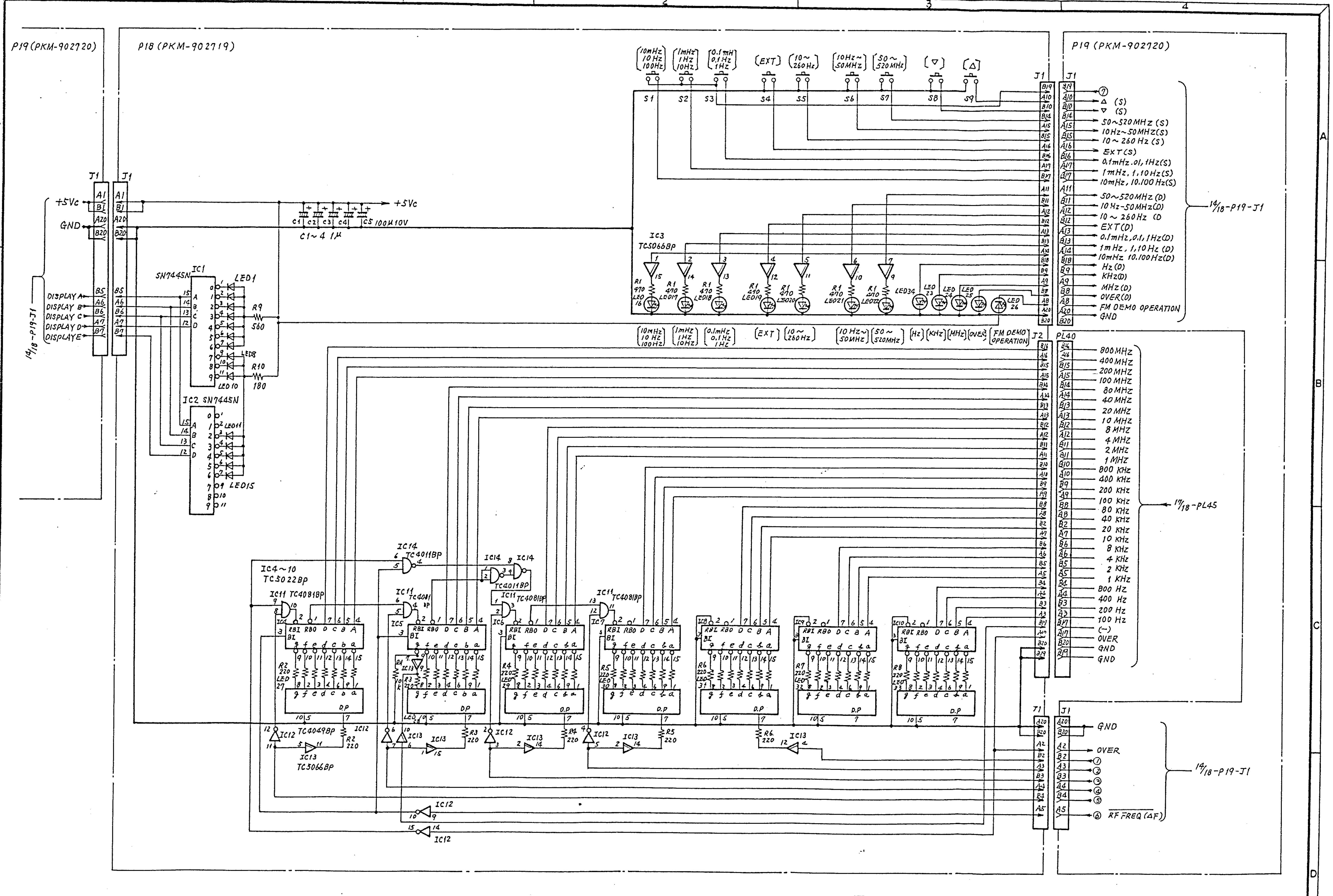
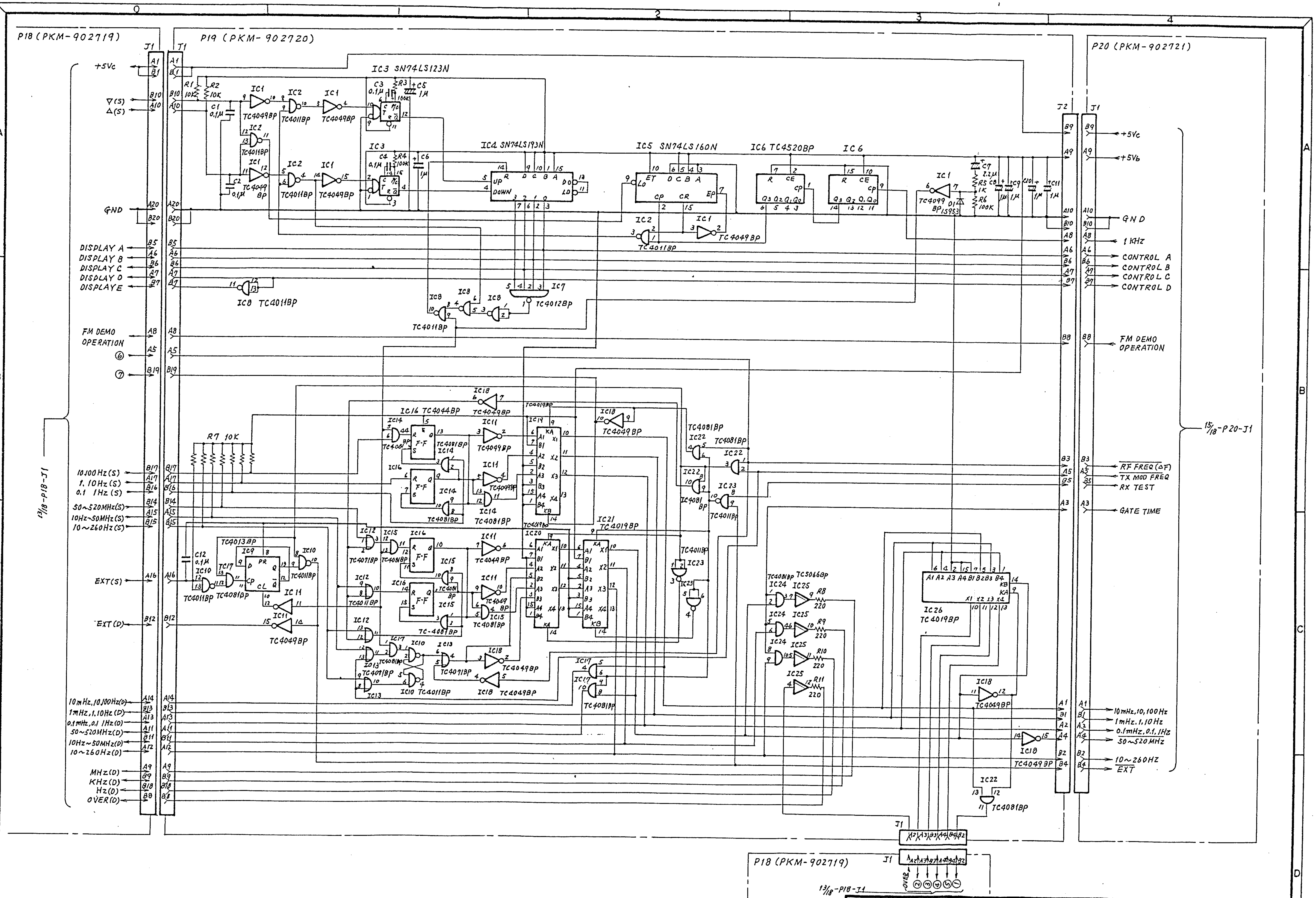


ENG.	CHKD.	APP.	TYPE AH-5403 RADIO TELEPHONE TESTER
			SCHEMATIC DIAGRAM
—	—	—	K-7417 13/18

NOTES | ISSUE 1 2 3 | DATE | CHKD. | NOTES | ISSUE 4 5 6 | DATE | CHKD.



ENG.	CHKD.	APP.	TYPE AH-5403 RADIO TELEPHONE TESTER
			SCHEMATIC DIAGRAM
—	—	—	K-7417 14/18

ISSUE	DATE	NOTES	CHKD.
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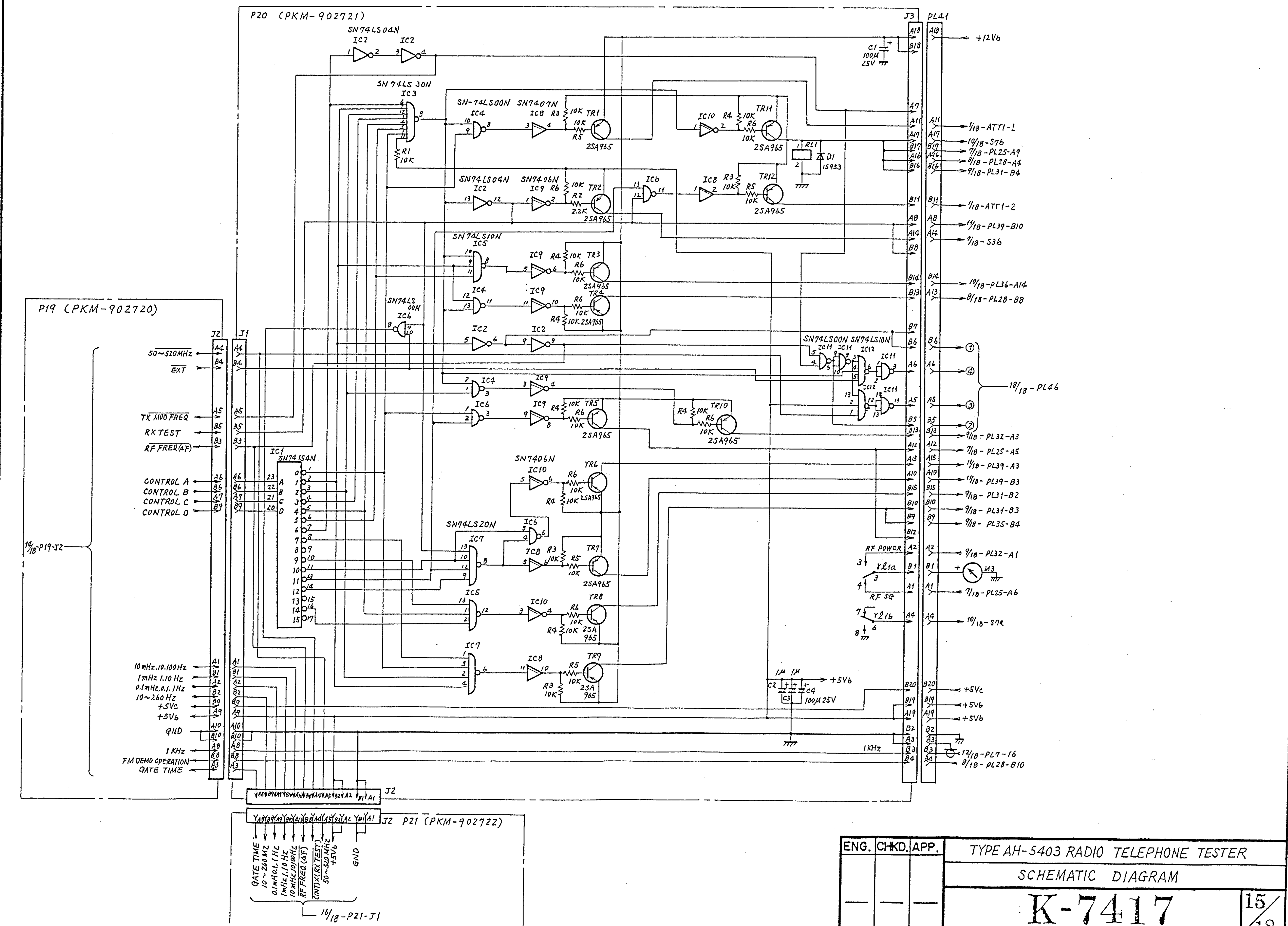

ISSUE	DATE	NOTES	CHKD.
1			
2	58 11 11	PL41-A11, B11 行先変更	青木
3			
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ENG.	CHKD.	APP.
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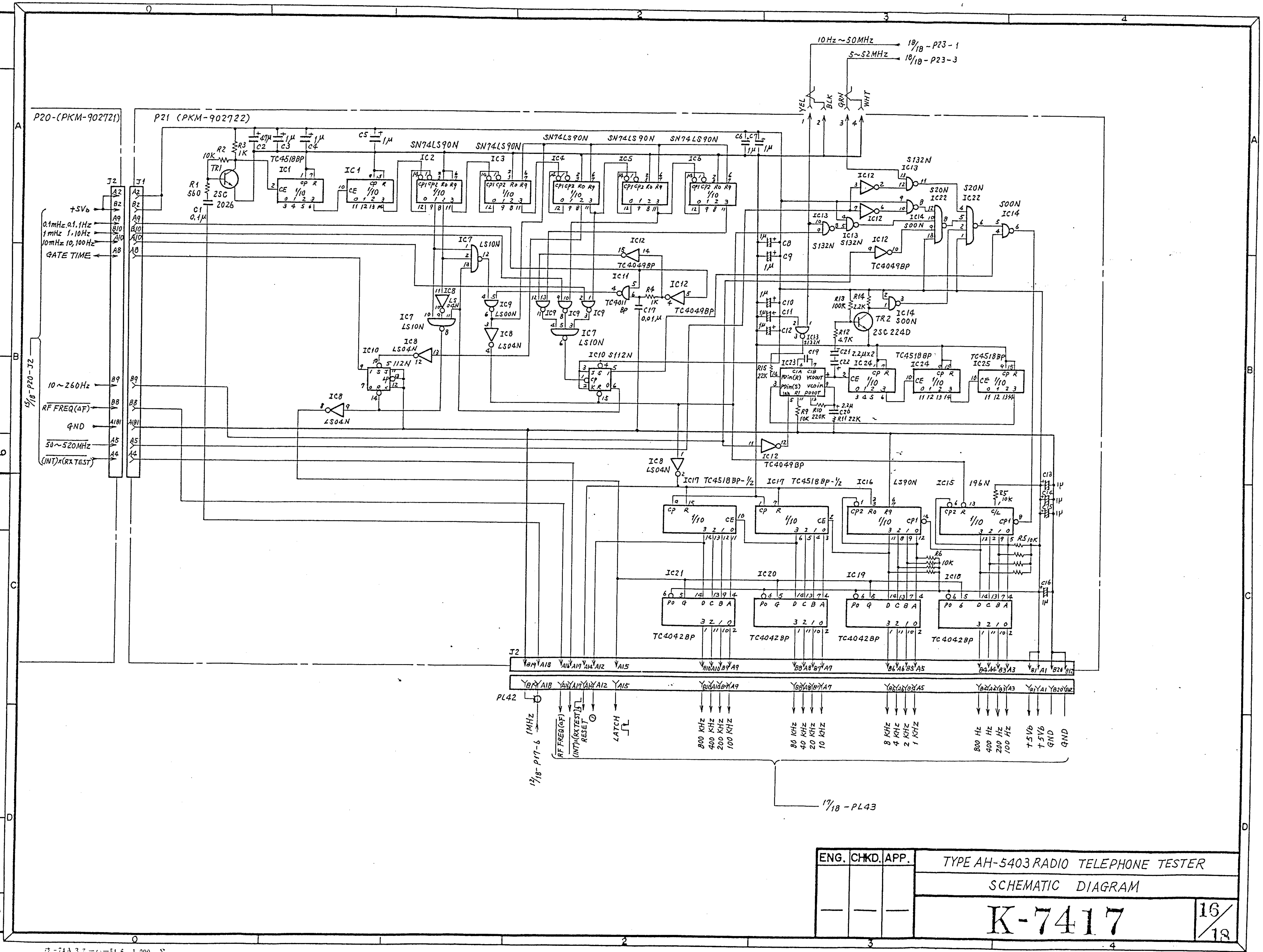
TYPE AH-5403 RADIO TELEPHONE TESTER

SCHEMATIC DIAGRAM

K-7417

15/18



ENG.	CHKD.	APP.	TYPE AH-5403 RADIO TELEPHONE TESTER
			SCHEMATIC DIAGRAM
—	—	—	K-7417 16/18

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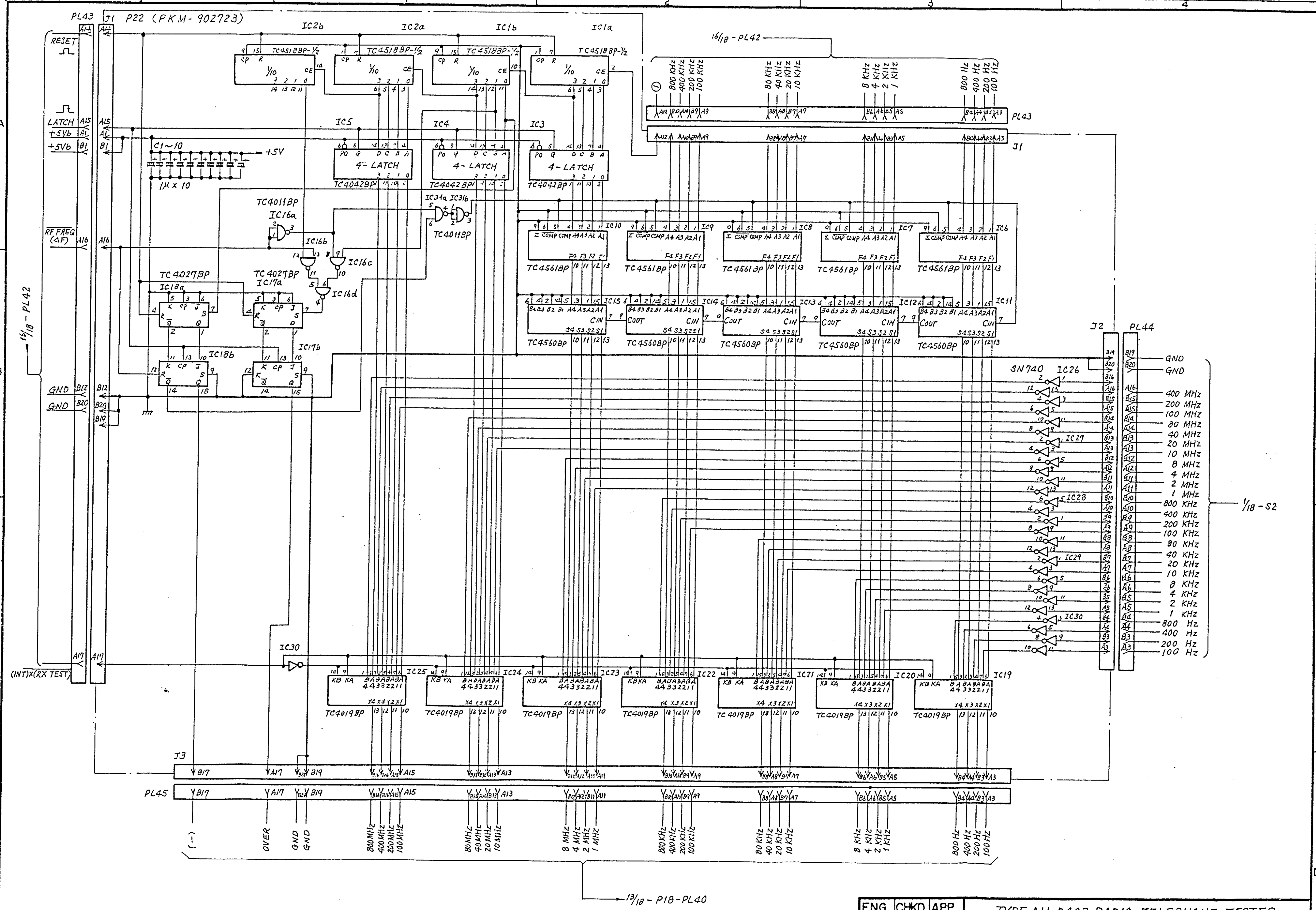

ENG.	CHKD.	APP.	TYPE AH-5403 RADIO TELEPHONE TESTER
—	—	—	SCHEMATIC DIAGRAM
			K-7417 17/18

ISSUE	DATE	CHKD.	NOTES
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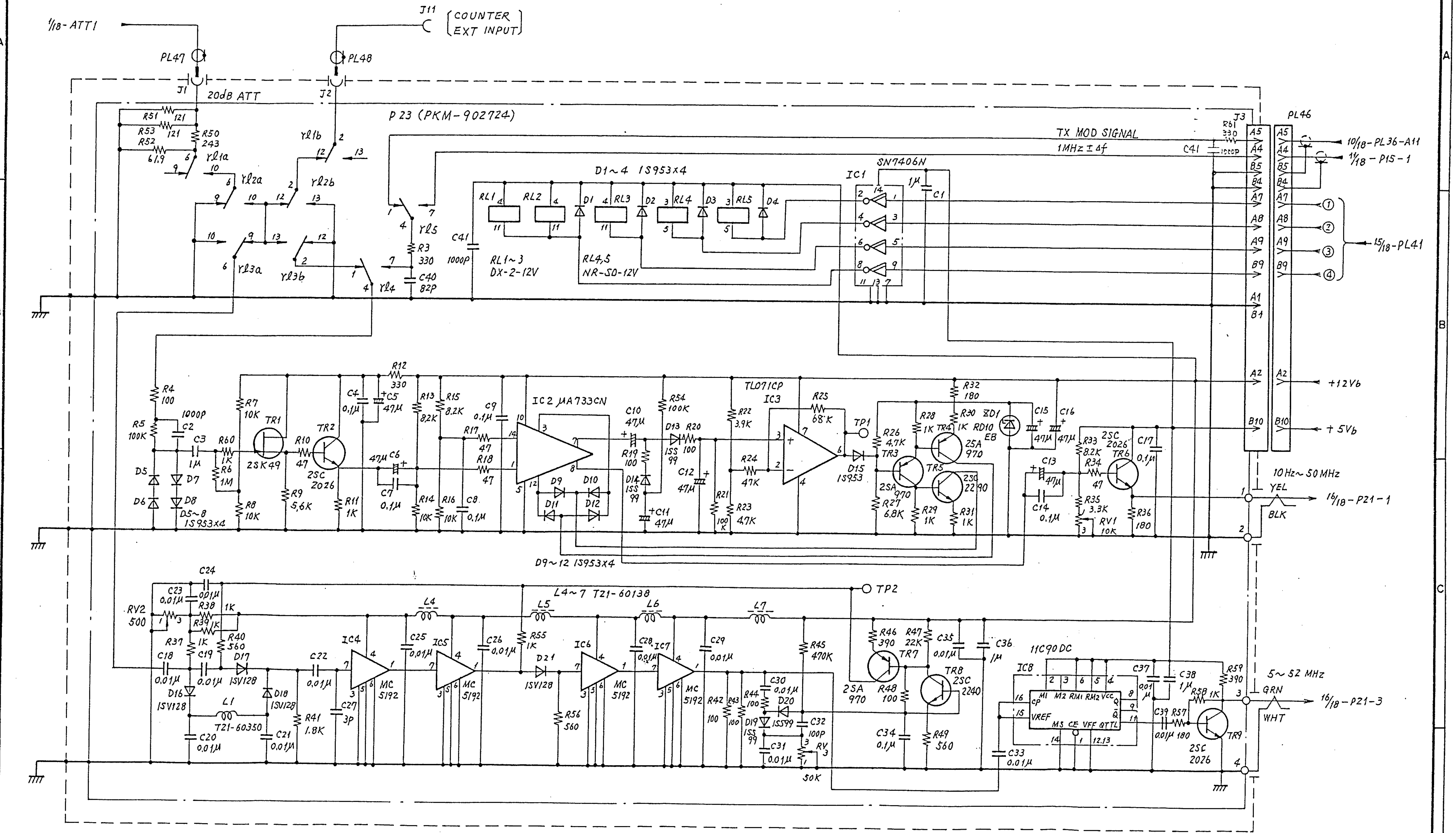


ENG.	CHKD.	APP.	TYPE AH-5403 RADIO TELEPHONE TESTER
			SCHEMATIC DIAGRAM
			K-7417 18/18

ISSUE	DATE	NOTES	CHKD.
1	58.4.26	C42 R61 追加, R25, C13, 36, 38 定数変更(7427-047)	小林
2			
3			
4			
5			
6			

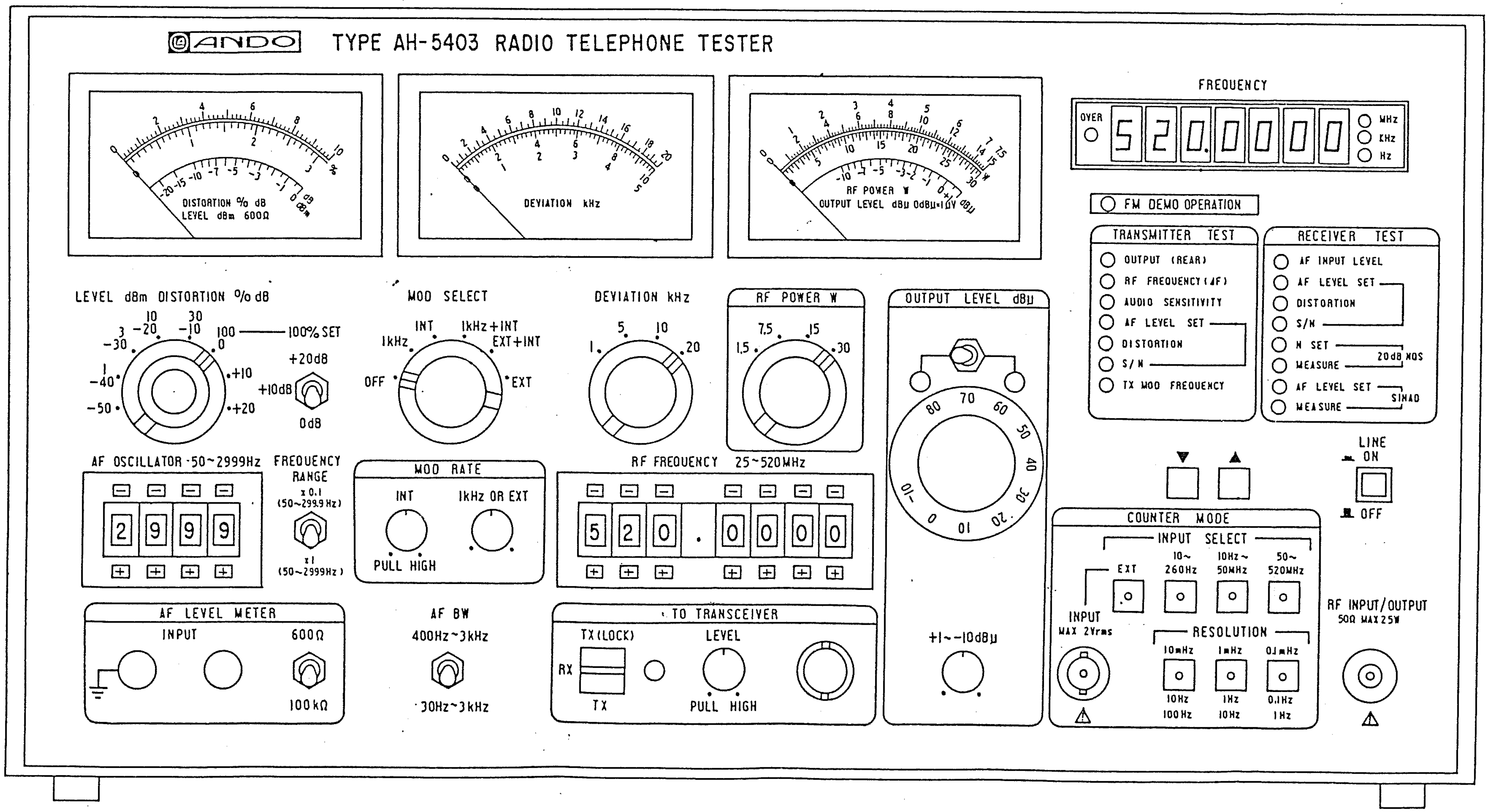
Table 5-1 Function and Relay's Operations

Functions \ Operations		Supply RF input signal to [RF OUTPUT (-40dB)]	Supply RF input signal to the FM linear detector	Supply SG output signal to the output connector	Turn on/off SG modulation signal (1kHz + tone signal)(Marked ○ : ON)	Turn on/off SG modulation signal (1kHz)(Marked ○ : ON)	Supply SG output signal to the FM linear detector LO	Change the deviation meter to the FM linear detector	Change the level meter to the FM linear detector output side	Power supply for TX lamp	A press-talk switch (S7a) signal for transceiver is grounded change the meter from RF level to RF power measurement	+1MHz shift	Turn off SG output signal	Turn off modulation signal for a transceiver	Change the frequency counter to RF FREQUENCY (ΔF) measurement	Change the level meter to DIST or S/N measurement side	When measuring S/N or DIST turn off the meter by setting the level switch to +10 or +20	Change the level meter to DIST measurement	Turn off FM linear detector output signal	Measure a modulation input level of a tranceiver	Turn of the level indication LED of output ATT	Change the frequency counter to TX MOD FREQUENCY measurement.
Circuit No.		ATTI			P5 RL2	P5 RL1	P7 RL1	P10 RL3	P12 RL4	S7b	P20 RL1	P3 IC18	P7 RL2	P14 RL1	P23 RL5	P12 RL5,8	P13 S1C	P12 RL6	P10 IC7	P12 RL10	S3a	P23 RL4
		①	②	③	PL39 A3	PL39 B3	PL25 A9	PL28 A4	PL31 B4			PL39 B10	PL25 A5	PL36 A14	PL46 A7	PL31 B3	PL35 B4	PL31 B2	PL28 B8	PL32 A3		PL46 A8
Pin No. of P20-J3		B12	A11	B11	A15	A10	B17	A16	B16	A17		A8	A12	B14	B6	B10	B9	B15	A13	B13	A14	B5
TRANSMITTER TEST	OUTPUT (REAR)	○						○			Ⓢ	L	○		H							H
	RF FREQUENCY (ΔF)		○					○			Ⓢ	L		○	L				○			H
	AUDIO SENSITIVITY		○					○			Ⓢ	L			H					○		H
	AF LEVEL SET		○					○			Ⓢ	L			H	○						H
	DISTORTION		○					○			Ⓢ	L			H	○		○				H
	S/N		○					○			Ⓢ	L		○	H	○						H
	TX MOD FREQUENCY		○					○			Ⓢ	L			H	○						L
RECEIVER TEST	AF INPUT LEVEL			○	○	○						H		○	H				○	○	Ⓗ	H
	AF LEVEL SET			○	○	○						H		○	H	○			○	○	Ⓗ	H
	DISTORTION			○	○	○						H		○	H	○		○	○	○	Ⓗ	H
	S/N			○	○							H		○	H	○			○	○	Ⓗ	H
	N SET	○										H	○	○	H	○			○	○	Ⓗ	H
	MEASURE			○								H		○	H	○			○	○	Ⓗ	H
	AF LEVEL SET			○	○	○						H		○	H	○			○	○	Ⓗ	H
	MEASURE			○	○	○						H		○	H	○		○	○	○	Ⓗ	H

○ : +12V L : Low level of TTL level H : High level of TTL level Ⓢ : Change signal circuit Ⓗ : +5V

Fig. 1 TYPE AH-5403 RADIO TELEPHONE TESTER

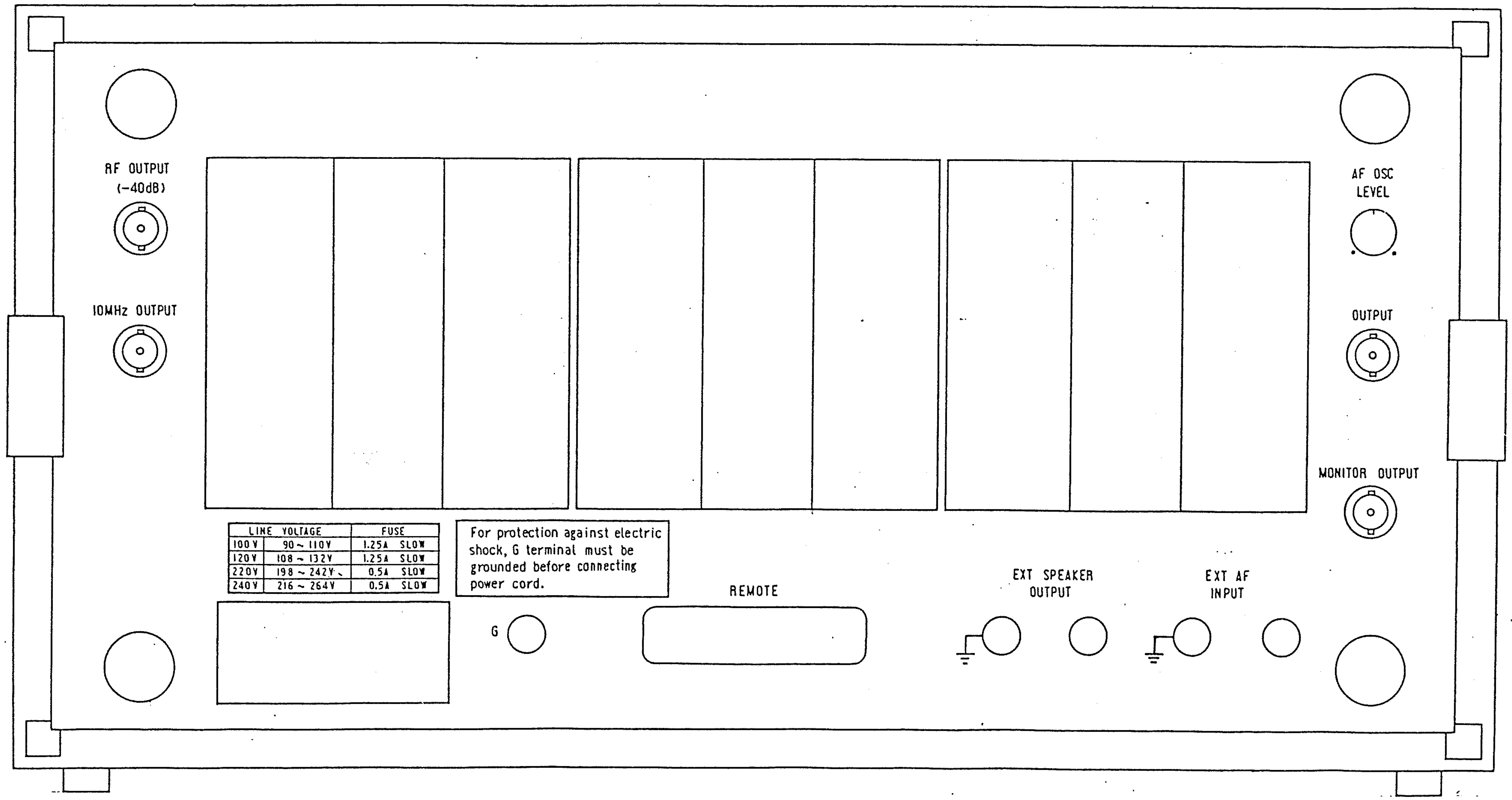
OUTSIDE VIEW (FRONT VIEW)



120

Fig. 2 TYPE AH-5403 RADIO TELEPHONE TESTER

OUTSIDE VIEW (REAR VIEW)



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